

GOVERNMENT OF INDIA

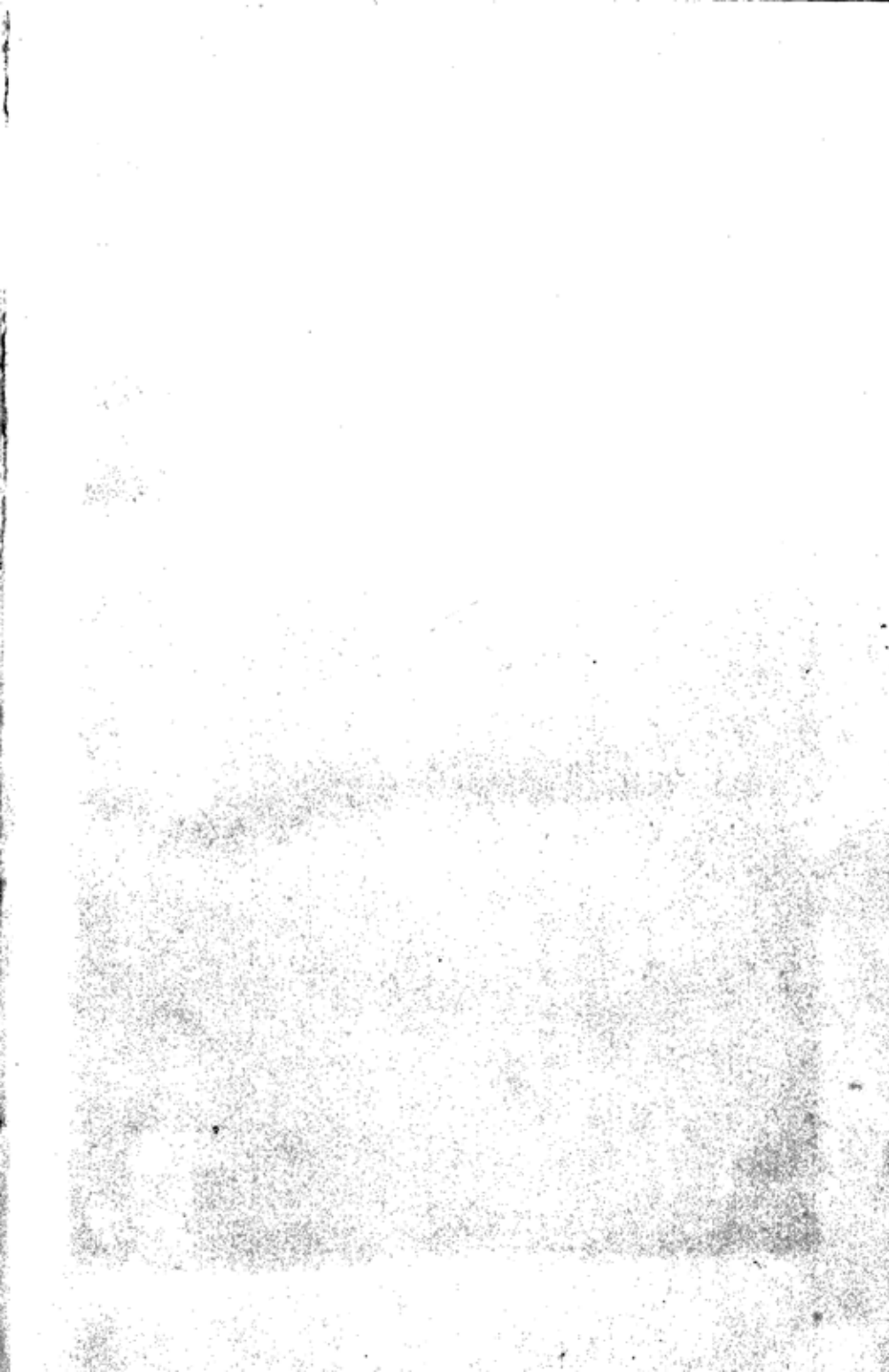
ARCHÆOLOGICAL SURVEY OF INDIA

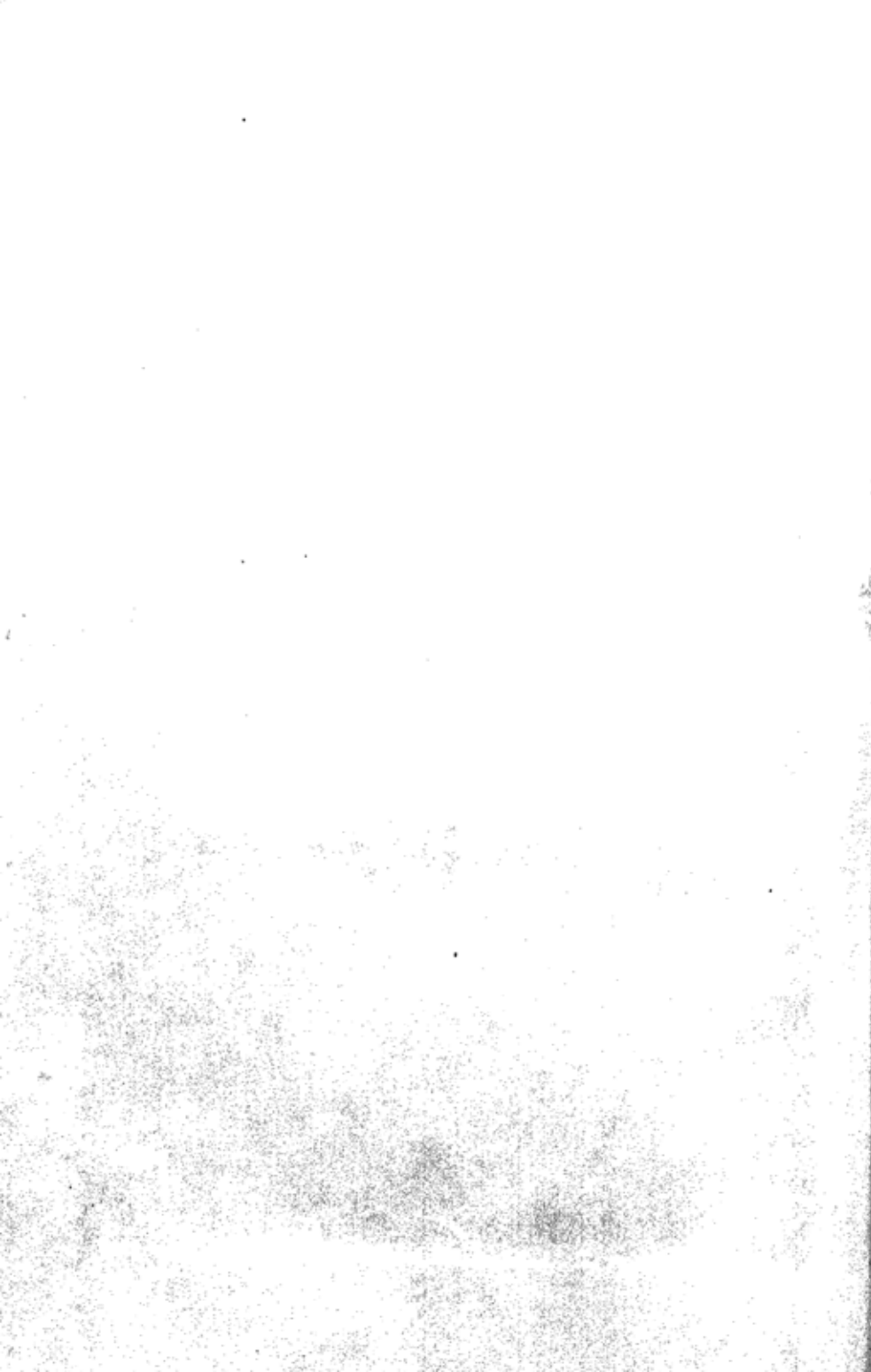
CENTRAL
ARCHÆOLOGICAL
LIBRARY

ACCESSION NO. 11586

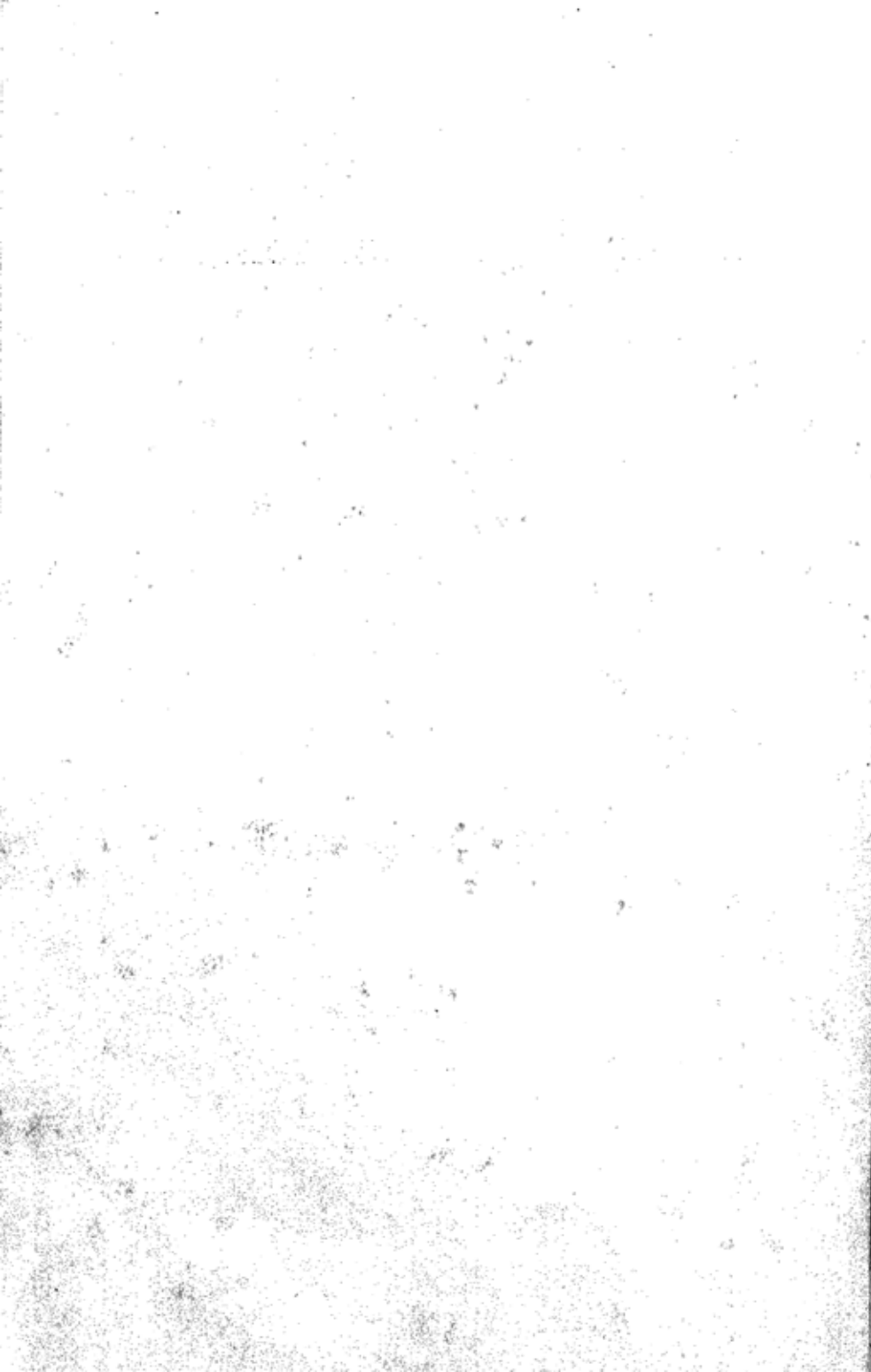
CALL No. 610.934 Kut

D.G.A. 79.





· ANCIENT INDIAN MEDICINE



Ancient Indian Medicine

BY

DR. P. KUTUMBIAH, M.D., F.R.C.P.

11586

FOREWORD

BY

DR. S. RADHAKRISHNAN

610.934

Kut



ORIENT LONGMANS

BOMBAY

CALCUTTA

MADRAS

NEW DELHI

ORIENT LONGMANS LIMITED

Registered Office : 17 CHITTARANJAN AVENUE, CALCUTTA 13

NICOL ROAD, BALLARD ESTATE, BOMBAY 1

36A MOUNT ROAD, MADRAS 2

5/3 ASAF ALI ROAD, NEW DELHI 1

SARABHAI ESTATE, SHAHPUR ROAD, AHMEDABAD 1

17 WOOD STREET, SHOOLAY, BANGALORE 1

GUNFOUNDRY ROAD, HYDERABAD 1

373/374 NARAYAN PETH, LAXMI ROAD, POONA 2

Also at 17 NAZIMUDDIN ROAD, DACCA

LONGMANS, GREEN AND CO. LTD

48 GROSVENOR STREET, LONDON W. 1

RAILWAY CRESCENT, CROYDON, VICTORIA, AUSTRALIA

443 LOCKHART ROAD, HONG KONG

LONGMANS OF MALAYA LTD.

44 JALAN AMPANG, KUALA LUMPUR

LONGMANS SOUTHERN AFRICA (PTY) LTD

THIBAUT HOUSE, THIBAUT SQUARE, CAPE TOWN

LONGMANS GREEN AND CO., INC.

119 WEST 40TH STREET, NEW YORK 18

LONGMANS CANADA LTD

20 CRANFIELD ROAD, TORONTO 16, ONT.

CENTRAL ARCHAEOLOGICAL

LIBRARY, NEW DELHI.

Acc. No. 11586

Date 7.9.62

Call No. 610.934

First published, 1962

Kut

© Orient Longmans Ltd., 1962.

PRINTED IN INDIA

at The Jupiter Press Private Limited, Madras-18.

To
my brother
P. CHENCHIAH
who took a keen interest in the writing of this
book but who did not live to see its publication
this book
is
affectionately dedicated.

Recd. from 1973 P. Chen Chieh Kuan 1973
for Mr. 1973

"It is easy to sneer at our ancestors . . . but it is much more profitable to try to discover why they, who were really not one whit less sensible persons than our excellent selves, should have been led to entertain views which strike us as absurd."

—THOMAS HENRY HUXLEY, 1881.

"I declare, however, that we ought not to reject the ancient art as non-existent, or on the ground that its method of enquiry is faulty, just because it has not attained exactness in every detail, but much rather, because it has been able by reasoning to rise from deep ignorance to approximately perfect accuracy, I think we ought to admire the discoveries as the work, not of chance, but of inquiry rightly and correctly conducted."

—HIPPOCRATES, on Ancient Medicine,
Jones Edition, Vol. 1, 1923, p. 33.

"The science of life has always been in existence, and there have always been people who understood it in their own way; it is only with reference to its first systematized comprehension or instruction that it may be said to have a beginning."

—CHARAKA SAMHITA, Sūtra Sthāna, 30, 24.

FOREWORD

Dr. P. Kutumbiah has given us in this book a scholarly and systematic study of ancient Indian medicine. While I am not competent to speak about the details which he has brought out with great care and learning, I heartily commend this book to the students of the history of medicine.

Ancient Indian medicine had the proper outlook on problems of health.

Charaka tells us :

dharmārtha kāma mokṣānām arogyaṁ mūlam uttamam.

Health is the chief basis for the development of the ethical, economic, artistic and spiritual sides of man. The wealth of a country depends not merely on its natural resources but also on the vitality of its people. If the people are sluggish, backward and inefficient, they will not be able to develop the resources of the country. In spite of rich resources the people will remain poor.

Charaka also tells us that the medical practitioner strives to do his work not with selfish motives or for worldly pleasures but for the relief of suffering humanity.

*nātmārtham nāpi kāmārtham
atha bhūta-dayāṁ prati.*

When our students of medicine were dynamic and vigorous they were able to accept ideas from other countries also.

Charaka says :

“The whole world is the teacher for the wise.”

Kṛtsno hi loko buddhimatām ācāryah.

The systems of medicine will have to keep pace with the developments of time. Our systems suffered because they were not able to reckon with the progress made.

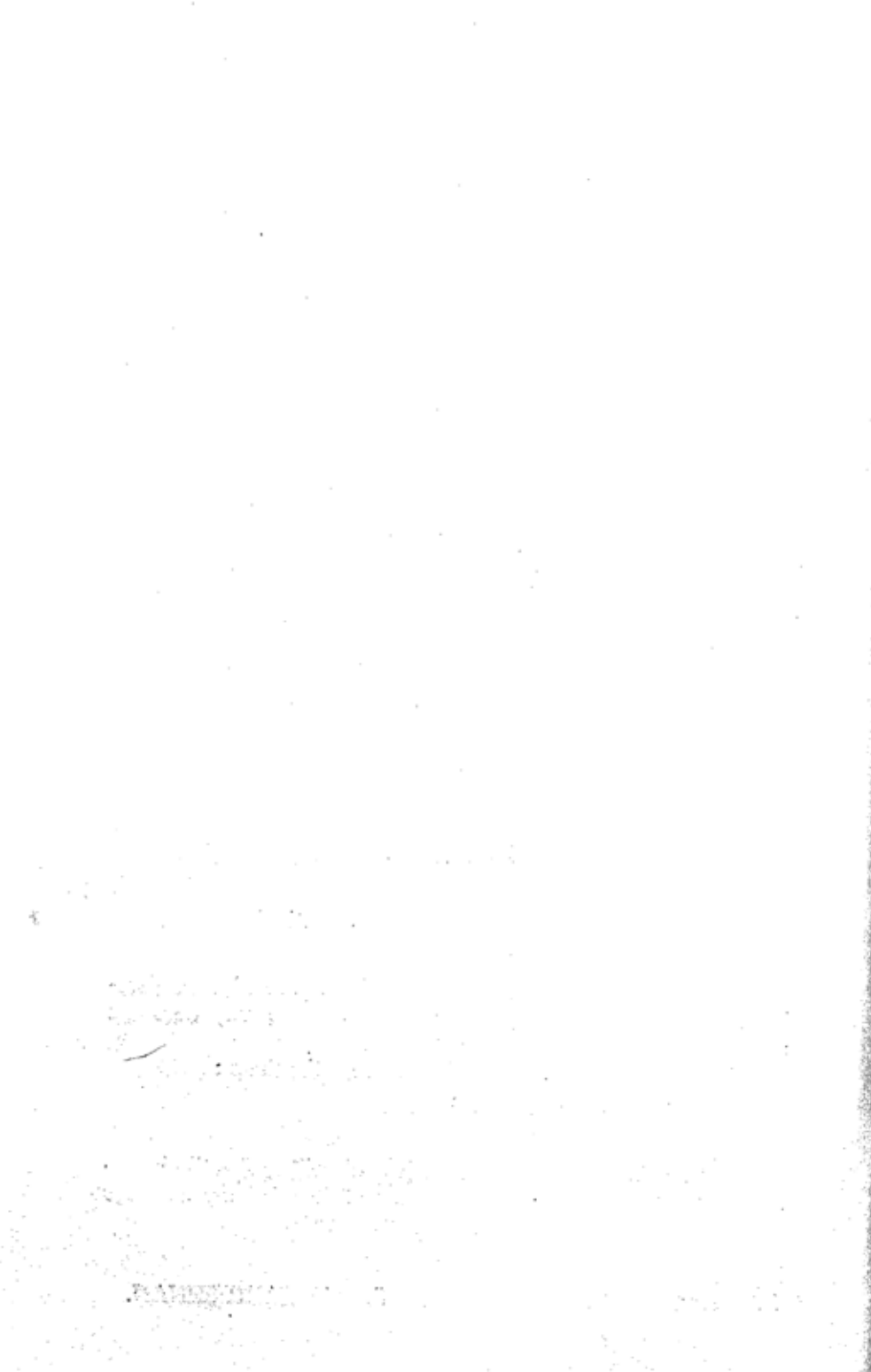
Vāgbhaṭa says that we should move with the times :

*yugānurūpa sandarbho hy ayam
sārah prakāśyate.*

I do hope that those who read this book will realise the fundamental truths of our ancient systems and also feel the need for reckoning with modern scientific developments.

New Delhi,
27th April, 1959.

S. RADHAKRISHNAN.



PREFACE

"India suffers today in the estimation of the world, more through the world's ignorance of her achievements than in the absence or insignificance of these achievements", observes H. W. Rawlinson.¹ This statement is well borne out in the case of ancient Indian medicine. The achievements of Indians in the field of medicine are but imperfectly known to the world even today. The ancient Indian medical classics, written exclusively in Sanskrit, were not easily accessible to any but Sanskrit scholars. Even in India, only a few were acquainted with these classics. The knowledge of medicine was held as a close preserve in a few families of hereditary physicians (Vaidyas). These Vaidyas were not used to modern ways of thinking, and the idea that they should share their knowledge with others or write books on the subject in other languages to make it known to the world at large did not appeal to them.

An interest in Sanskrit studies was first roused in England and Europe, by the pioneering efforts of Sir W. Jones and H. T. Colebrooke, towards the close of the 18th century. In 1786 Sir William Jones founded the Asiatic Society of Bengal and through the Journal of this Society a large volume of Sanskrit literature in English translation was made available to the English-speaking world. Alexander Hamilton in 1802 introduced a few French scholars and the German romantic poet, Friedrich Schegel, to Sanskrit literature and thus created an interest in Europe in its study. Macdonnell considers this discovery of Sanskrit literature by the West the most significant event in the history of culture since the Renaissance. The interest thus awakened was so tremendous that in the course of the 19th century, the whole range of Sanskrit literature was explored, the great bulk of it edited and most of its valuable works translated into English, German, French and Latin. In the early days of Sanskrit studies, the European scholars concentrated their attention mainly on philology and general literature. It was only much later their studies were directed to the earlier and more important literature of the Vedas; but unfortunately even then these studies did not extend to the medical classics.

H. H. Wilson, succeeding Sir W. Jones and H. T. Colebrooke, introduced ancient Indian medicine to the forum of Western science through his essay "On the Medical and Surgical Sciences of the Hindus" in 1823. He was followed by J. F. Royle with a study of "The Antiquity and Independent Origin of Hindu Medicine" in 1837. T. A. Wise in 1845 published the first comprehensive treatise on Indian medicine in any foreign language. This book was entitled "A Commentary on the Hindu System of Medicine". These publications do not seem to have created any stir in the Western medical world and any interest they might have created soon died down. After a lapse of about sixty years, A. F. H. Hoernle revived the languishing interest in ancient Indian medicine by the publication of his "Studies in the Medicine of Ancient India, Part I : Osteology" (1907). This was followed by a series of critical and scholarly articles entitled "Studies in Ancient Indian Medicine" in the *Journal of the Royal Asiatic Society* (1906-1910). Besides these studies he edited the Bower Ms. with consummate skill and scholarship (1893-1912).

The commencement of the 20th century witnessed the publication of "The Encyclopedia of Indo-Aryan Research". This monumental work, covering the whole domain of Indo-Aryan antiquity, contained many valuable studies on ancient medicine, e.g. Bloomfield on "The Atharva Veda", Hillebrandt on "A Survey of the Vedic Spells against Disease", and Jolly on "Indian Medicine". Jolly's contribution was an epoch-making one and now there is an English translation of this work by Kashikar (1951). Dr. Max Neuburger, the philosopher-historian, in his "History of Medicine", Vol. I, has a very appreciative and at the same time critical study : "The Medicine of the Indians". There is an English translation of this work by E. Playfair (1910). The colossal task of translating into English the Charaka Samhita was successfully accomplished by Kaviratna Avinash Chander (1890-1911). The Susruta Samhita was translated into English by Kaviraj Kunja Lal Bhishagratna (1907-1918). These translations have made the great Indian medical classics easily accessible to the English-speaking world.

The chief cause of the world's ignorance of the achievements of the ancient Indians in the field of medicine is not, at the present time, the lack of available literature on the subject but the confirmed belief among medical historians that ancient Indian medicine has not contributed and has nothing to contribute to

the evolution of modern medicine. "The medicine of Egypt and the East, extensive and intricate as it was, in so far as it is not Greek, did not contain even the rudiments of science. To it Western medicine owes virtually nothing",² was the opinion expressed on the medicine of the East at the commencement of this century by C. Allbutt, and this may be taken as the measure of the knowledge possessed by the West of the achievements of ancient Indian medicine. This belief has led to the obsession of the medical historian that scientific medicine began with the Greeks. The work of the scholars mentioned above has not succeeded in dispelling this obsession. The discovery and study of the medical papyri of Egypt have made medical historians revise their opinions. W. R. Dawson writes : "That the foundations of medical science were laid in Egypt more than fifty centuries ago there can no longer be any reasonable doubt."³ The main thesis of the present study is that scientific medicine flourished in India long before it did in Greece.

Neuburger introduces his study of "The Medicine of the Indians" with the remark : "The medicine of the Indians, if it does not equal the best achievements of their race, at least nearly approached them, and owing to the wealth of knowledge, depth of speculation, and systematic construction, takes an outstanding position in the history of Oriental medicine."⁴ But other medical historians have either ignored its existence or, when they deal with it, show little appreciation of its importance. Of all the ancient medicines, that of India is undoubtedly in intrinsic merit and historic value, the most important, especially as a source for the study of the evolution of medicine. Its earliest period, being much older than that of Greek medicine, presents a more primitive form of medical speculation and therefore gives a clearer picture of the development of medical ideas. The greatest interest, however, which the study of ancient Indian medicine must have for the medical historian lies in the fact that it presents to him the development of medical concepts from their primeval origins in empiricism and theurgy to the apprehension of the fundamentals of a science of health and disease.

No apology is needed for a work on ancient Indian medicine. Most of the books on Indian Medicine we have mentioned above are out of print and out-of-date. Jolly's "Indian Medicine" is now available in English translation, but it is a book for the scholar and not for the novice. It is more in the nature of a source book and presupposes a good knowledge of the Indian

medical classics. Neither is the recent work of Zimmer on "Hindu Medicine" a book for the general reader. It is a philosopher's dissertation on Indian medicine and as such gives only a limited view of it. The earlier English editions of Charaka and Susruta are out of print and very difficult to obtain. There is a new translation of Charaka Samhita in six volumes by the Jamnagar Institute (1951). However, very few will have the enthusiasm and patience to wade through these voluminous tomes in an English translation to get an idea of Indian medicine. Besides, many discoveries and facts have come to light since the publication of these books. The discovery of the Indus Valley Civilisation has considerably widened the horizon of Indian medicine, and has pushed its antiquity back to about 2500 B.C., thus making this civilisation contemporaneous with the three non-Aryan civilisations of the ancient world. All these new developments call for a fresh study of ancient Indian medicine in this new context of history. The need for a book which gives a clear and connected account of ancient Indian medicine, its origin, development and inter-relations, its role in the evolution of medicine and its achievements in the light of recent archaeological discoveries and other data, has long been felt. This book aims at supplying this need.

I am indebted to my friend Dr. C. Mallick, M.R.C.S., L.R.C.P., registered medical practitioner, Vizagapatam, India, for the suggestion to write a book on ancient Indian medicine. He was a keen student of Indian medicine and had collected for his own study much literature on this subject. He gave me his whole collection to use in writing this book. I also owe a debt of gratitude to my friend Sri A. V. Bhanoji Rao of Vizagapatam, for having placed at my disposal the rare collection of books on Indian medicine and allied subjects from his father, Rajah Jagga Rao's library. Without the generous help of these two friends I could not have ventured on this work. No writer on ancient Indian medicine can afford to dispense with the help of Dr. Hoernle's valuable studies on the subject. I have drawn freely from his book on osteology, his critical studies on ancient Indian medicine and his invaluable edition of the Bower Ms. But the book to which I am very deeply indebted is Prof. Dasgupta's "A History of Indian Philosophy" Vols. I & II. Chapter XIII in Vol. II, entitled "Speculations in the Medical Schools" is the most comprehensive and erudite discussion we have of the fundamental conceptions of ancient Indian medicine. It is a great pity that this very valuable study lies buried in a book on

philosophy and is not sufficiently known to the medical world. I have made full use of these two volumes in my exposition and presentation of the views of the ancient medical writers and their philosophical concepts.

A few remarks on the title of this book are necessary. This book covers the period of Indian medicine from its beginning to the end of its classical period, which may be considered to have reached its zenith in the time of Susruta, Charaka and Vāgbhaṭa I. These three authors have been termed "the triad of ancients" (*Vṛiddha-trayi*). After these masters, no original work of any importance was accomplished. The authors who followed these masters were their imitators and abstractors. The last author of this period was Vāgbhaṭa II, whose date was about the 9th century A.D. After this century a distinct change is noticeable in Indian medicine. New elements are incorporated into it. These elements are : *nādi-pariksha*, the use of opium, mercury and its compounds in therapy. *Nādi-pariksha* and opium are not even mentioned in the ancient Indian medical classics. At this period, the process of calcination of metals does not appear to have been known ; mercury is occasionally mentioned but purified mercury and other mercurial preparations and mixtures are not mentioned at all. These importations from foreign sources completely altered the character of classical Indian medicine. A correct appreciation of Indian medicine, therefore, must be based on the ancient medical classics.

This book has been long in the making. I started collecting the necessary materials for it as far back as 1935. Its writing was very much delayed by World War II and the pressure of professional work. Parts of it have, however, been published from time to time as articles in the Journal of the Andhra Medical College, Vizagapatam (1936-1940) ; the Medical Bulletin of Bombay (1939) ; the Journal of the Anatomical Society of India (1956 and 1957) ; the Indian Journal of the History of Medicine (1956 and 1957). These have been incorporated in a revised form. I am grateful to the editors of these journals for their permission to utilise the above articles.

It now remains for me to thank all those who have rendered me valuable help in getting the book ready for the press and have expedited its publication. My thanks are due to Dr. D. L. Graham, M.D. and Dr. D. M. Jefferson M.D., M.Sc., for the help they rendered in going through the typescript and making the necessary corrections and for the many valuable suggestions made.

My thanks are specially due to Mr. Arthur Osborne of Ramana-shramam, Tiruvannamalai, for looking through the typescript generally; to Dr. "Sri Hari", a retired Professor of Ayurveda in Madras, for helping the publishers to clear various doubts from time to time, while the book was going through the press; and to Sri C. S. S. Thathachari, Sri T. Rangaswami and Sri P. S. Ramaswamy of the staff of the publishers for going through the proofs.

To the publishers I owe a special debt for their ready co-operation and unfailing courtesy throughout.

The book is at last completed and is sent forth into the medical world with the fervent hope that it will bring knowledge of the achievements of ancient Indian medicine to a much wider reading public than hitherto, thereby establishing it in its legitimate place in history.

Vellore,
20-3-1962.

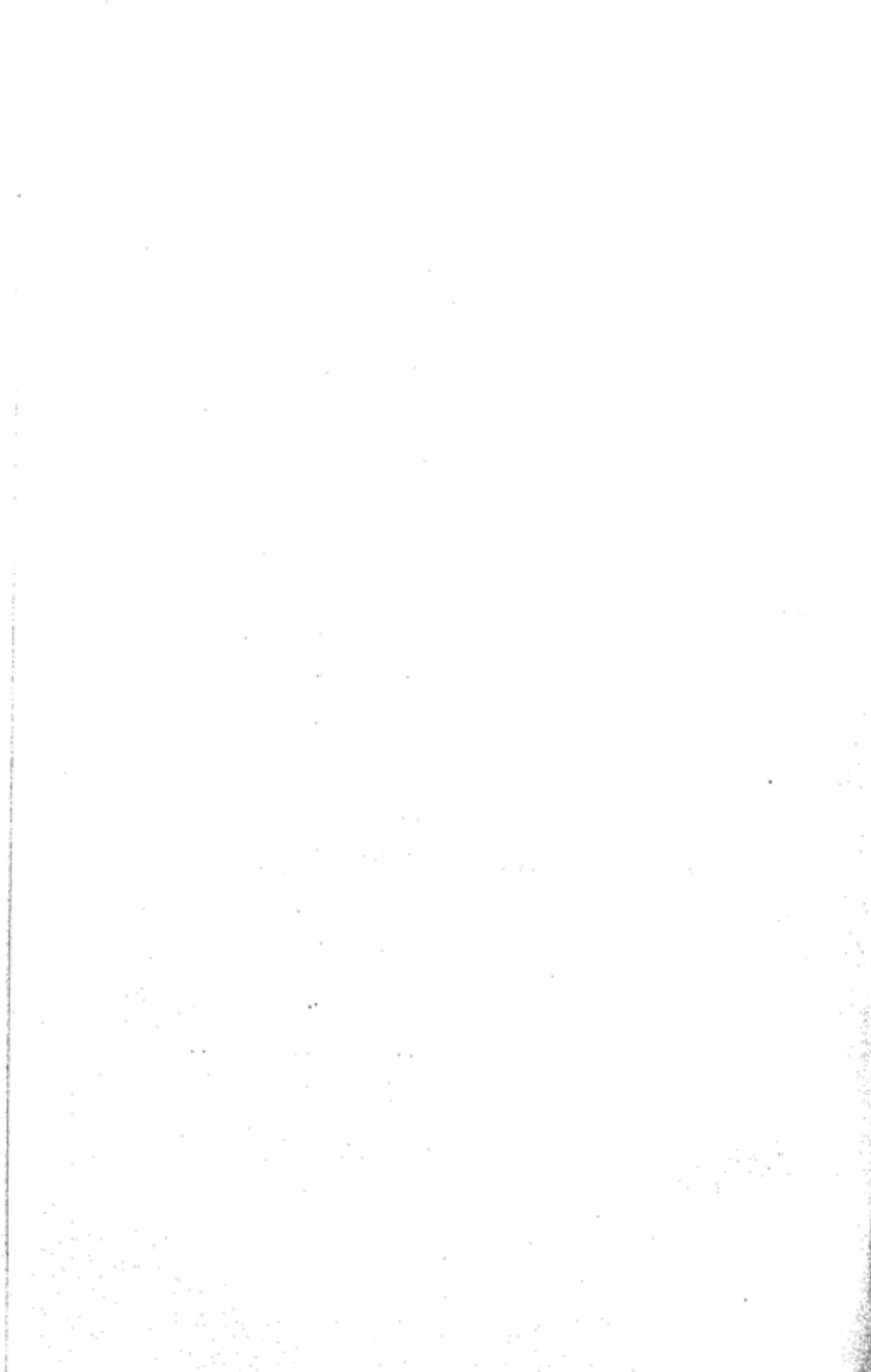
P. KUTUMBIAH.

PUBLISHER'S NOTE

The Publishers acknowledge with gratitude the kind assistance of the Ministry of Health, Government of India, for the publication of this book.

CONTENTS

	PAGE
Foreword	vii
Preface	ix
General Introduction	i-liv
Chapter I Ancient Indian Anatomy	1
Chapter II Physiology	34
Chapter III The Doctrine of Tridoṣa	57
Chapter IV Aetiology, Classification and Pathology of Diseases	76
Chapter V Diagnosis and Prognosis	90
Chapter VI Materia Medica	107
Chapter VII Treatment	130
Chapter VIII Surgery in Ancient India	144
Ophthalmology	171
Chapter IX Obstetrics, Gynaecology and Paediatrics	177
Notes and References	203
Index	213



GENERAL INTRODUCTION

THE ORIGIN OF ANCIENT INDIAN MEDICINE

Āyurveda is the name which the ancient Indians gave to their science of medicine. *Āyuh* means life and *veda* to know or attain. Āyurveda, therefore, is the science by the knowledge of which life can be prolonged or its nature understood.¹ The Vedas are the earliest sacred books of India. They are four in number, viz., Rigveda, Samaveda, Yajurveda and Atharva-veda. They were handed down by word of mouth from a period of unknown antiquity; and the Hindus believed that they were never composed by man. It was supposed that they were taught by the gods to the sages, or revealed to the sages, who were the seers of truth. There was really no Veda called Āyurveda. Its existence is a myth. Susruta calls it an upāṅga of the Atharva-veda. It was raised to the status of a Veda and appended to the Atharva-veda to give the science of medicine the necessary sanctity and authority. In accordance with the traditional origin of the Vedas, it was supposed to have been divinely revealed to the sages. There are two versions of its origin. The medical school traces its origin to Bharadvāja, who received it from the god Indra. The surgical school traces its origin to Dhanvantari who received it also from this god.²

According to Charaka (C.S. I. 1), Āyurveda emanated from the Creator, Brahma, who revealed it in its entirety to Prajāpathi, 'Lord of the Creatures'. From him it was passed on to the Aswins, the divine twin horsemen, the helpers and healers among Vedic gods. They passed it on to Indra, king of the gods, and from him mankind received its divine wisdom. When moral perfection and saintliness, as they prevailed in the ideal beginnings of time, began to decrease in the course of ages, disease made its appearance; thus the span of life was shortened and the fulfilment of religious duties hindered, along with that of vows, austerities and the pursuit of enlightened sanctity. Then, out of compassion for all beings, holy seers gathered on an

auspicious slope of the Himalayas and took to meditation on the problem ; " By what means can disease be checked, since freedom from disease is the elementary requirement for all religious, secular and spiritual pursuits ? " With the inner eye of intuition they beheld Indra and realised, " the king of the gods will reveal to us the means of checking disease, but who shall proceed to his celestial mansions and ask him ? " One among them, the holy Bharadvāja, cried out, " Let it be I ". He proceeded to Indra's heavenly abode and the king of the gods revealed the Āyurveda to him, condensed in a few words. The holy seer grasped the " boundless and shoreless, eternal and auspicious science," which is the last and best resort for the hale and the sick, in the form of three aphorisms containing the knowledge of the causes (*hetu*), the symptoms (*linga*) and the remedies (*auśadha*) of disease. Through this wisdom Bharadvāja gained unlimited life and so did the holy seers to whom he proclaimed it. With the eye of intuitive knowledge they duly beheld similarities and dissimilarities, qualities, individual substances and their specific active properties, as well as the possible combinations of their virtues and the inseparable inherence of one item in another. Thus the condensed wisdom unfolded, and one of the saints, Punarvasu Ātreya (the descendant of Atri), out of compassionate love for all beings, taught the Āyurveda orally to six disciples ; Agnivesa, Bhela, Jātukarna, Parāsara, Hārīta and Kṣīrapāni. There was no difference in the saint's teaching, but a diversity of intelligence among his pupils ; therefore, Agnivesa was the first to compile a treatise. The other five disciples also wrote treatises and when the six works were recited before the assembly of seers headed by Punarvasu, they agreed that all the books had been duly compiled.

The origin of Āyurveda, as revealed by Dhanvantari to Susruta, is as follows : Susruta along with the sages thus addressed the immortal Lord Divodasa Dhanvantari, king of Benaras, who was sitting in his hermitage, surrounded by sanctified sages. " Oh lord, we are much grieved to see around us human beings suffering from bodily, mental, accidental and natural diseases, who lament and cry aloud like helpless beings without any friends or means. For the restoration or cure of these health-seeking individuals, for the preservation of our own lives and for the good of mankind, we have come here to be instructed in the Āyurveda or the medical science, hence we have approached your worship as pupils."

Dhanvantari replied, " You are welcome. You, my sons, are well educated and qualified to receive instruction in Āyurveda.

The Āyurveda is a subsidiary branch of the Atharva-veda. Brahma composed it in one hundred thousand slokas and a thousand chapters, before the creation of man. Afterwards, in consideration of the short lives and the limited intellectual capacity of human beings, he divided it into eight chapters, viz., Salya, Sālākya, Kāyachikitsā, Bhūtavidyā, Kaumārabhr̥tya, Agada tantra, Rasāyana tantra and Vājīkarana tantra.

"Brahma first expounded the Āyurveda to Prajāpati, who taught it to the two Asvini-Kumars. From these twins, Indra studied the subject and from Indra I obtained the knowledge. Now for the good of mankind it is my duty to impart this knowledge to those who seek for it in this world. It is I who cured the diseases of the gods and prevented their deaths and decrepitude. I have now come to this world to lecture on Salya Tantra and the other divisions of the Āyurveda in a comprehensive way." (S.S. I. 1).

PRE-VEDIC MEDICINE : THE MEDICINE OF PREHISTORIC INDIA

Prehistoric India, in its widest sense, may be said to comprise all the human communities in the sub-continent, from the old stone age to the time written history begins. Writing was known and employed in the Indus Valley Civilisation in the third and the second millennia B.C. but its peculiar script has yet to be deciphered. So virtually the Indus Valley Civilisation belongs to prehistoric India. Indian prehistory extends from the earliest times to the Aryan invasion of India; i.e., about 1500 B.C. So a convenient division of pre-Vedic medicine would be from the earliest times, including the paleolithic and the neolithic ages, to the Indus Valley Civilisation and thence to the Vedic period.

Abundant stone implements of the paleolithic age and vast remains of the neolithic age have been found in Madras State. But, curiously enough, so far, no skeleton of any prehistoric man has been found in India.³ This makes it rather difficult to conjecture the culture of the stone age people in India. We have no reason to believe that this culture did not follow the same pattern as that of other parts of the world. We do not know who the original inhabitants of India were. Racial anthropologists inform us that there is no particular race of man belonging to ancient India, but about six different races have, from time to time, migrated from outside and have taken root in India. These races are : the Negrito, the Proto-Australoid,

the Mediterranean, the Mongoloid, the Western Brachycephals and the Nordic. Of these the Proto-Australoids and the Dravidians seem to have been the earliest, and still survive in a good many aboriginal people of present-day India, although more or less mingled with other people.⁴ These aboriginal tribes fall into two great classes, viz., that of the Kolarians, who speak the Munda language, a branch of the Austric family of languages, and that of the Dravidians, a type of the Mediterranean race. The chief representatives of the Kolarians are the Kols, the Koches, the Santhals, and the Savaras, and of the Dravidians, the Khonds, the Gonds, the Oraons and the Todas.⁵ These tribes are the remnants of the two earliest known races of India. A study of their cultures may give us an idea of the habits, religion and medical beliefs of their ancestors. Though this method is open to very grave objections, we have no other means of gaining the required knowledge. These tribes still retain most of their ancient customs and habits and lead a primitive life.

A study of the customs, habits and modes of living of these aboriginal tribes reveals that their religion is animistic, consisting in the worship of many spirits and demons, each class or tribe having its own objects of worship. They have stones for idols but no temples. They sacrifice animals to their gods. Some of them revere Manes (the spirits of the dead) and countless local and sylvan deities. Most of these tribes worship snakes and trees. They have many totems, such as the mouse-totem of the Oraons and the goose-totem of the Santhals. They consider disease the result of malevolent influences exercised by a god or supernatural being, or by another human being, alive or dead. Disease is a magical or a magico-religious, rather than a natural phenomenon with them. As diseases are attributed to supernatural causes, they are treated by magic, incantations and other rituals. To ward off diseases they use charms, amulets, and talismans. Their medicine may be correctly described as primitive.

We next come to the millennium between 2500 and 1500 B.C. Wheeler has termed this period the "dark millennium" in Indian history.⁶ The archaeological discoveries at Harappā, Mohenjō-dāro, Chanhū-dāro and other sites in the Indus Valley have disclosed that, at the dawn of history, there existed in the plains of the lower Indus, an extensive, highly evolved chalcolithic culture. This has been named the Harappā or Indus Valley culture or civilisation. It was in full flower in the time of Sargon of Agade (in Mesopotamia) whose date is now placed a little before 2300 B.C. Wheeler estimates the period 2500 to 1500 B.C. as

likely to have comprised the material available, without prejudice to any evidence that may eventually be forthcoming from the unplumbed depths of Mohenjo-dāro or Chanhu-dāro.⁷

We do not know with certainty who were the authors of the Indus Valley Civilisation. "The sum of the evidence from the skulls discovered at Mohenjo-dāro and Harappā shows that in the Harappā culture there was, first, the aboriginal Proto-Australoid type, perhaps, then as now, ranking among the underdogs of the social system; second, the predominant Mediterranean type, presumably the main contributors of the agricultural and urban features of the whole prehistoric world, and with them probably the short-headed Alpine element; thirdly an occasional foreigner from the north-east—the hill-country of Nepal or Assam, possibly from China itself—but he is perhaps present as an invader." "The Mediterranean type at the present day includes a large number of groups of people stretching from Iberia to India. The characteristic types may have been differentiated in the southern steppes of North Africa and in Asia and spread westwards and eastwards. The pre-dynastic Egyptians certainly belonged to this stock and the purest representatives of this type at the present day are to be found in the Arabian peninsula. In India it forms today a dominant element in the population of the north and is widespread elsewhere among the upper social classes. The appearance of this early Mediterranean folk in prehistoric India must be related to expansion from the West."⁸ Anthropologists assume at least three varieties or modifications of the Mediterranean race as having come to India, viz., the Paleo-Mediterranean, the Mediterranean proper, and the so-called Orientals. All of them were speakers of Dravidian languages, at least in India.

"Before the discovery of the Indus Valley Civilisation it was assumed that the Aryan invaders encountered a rabble of aboriginal savages who could have contributed little, save a few animistic beliefs, to Vedic thought and nothing to the structure of the later Indo-Aryan society." "Our knowledge, that the Indus Valley Civilisation was flourishing in Northern and Western India at the beginning of the second millennium, centred on cities with strongly fortified citadels and containing among its population a large proportion of Proto-Australoids with dark skin and flat noses and that the cities came to a sudden and violent end, makes the identification of the Dāyus and Dāsas of the Vedas with the inhabitants of the Indus Valley Civilisation something near certainty."⁹ We also know that the Mediterraneans formed a predominant part of its population. So the rabble of aboriginal

savages, the Dāyus and Dāsas, whom the Āryan invaders met with and conquered, were none other than the inhabitants of the Indus Valley Civilisation.

Since the discovery of the Indus Valley Civilisation it has been recognised that many elements in medieval and modern Hinduism, which cannot be traced to an Āryan source, are, in fact, foreshadowed in what we know by inference of the religious cults of the older civilisation. "It is now generally admitted that the Proto-Australoids and the Dravidians have contributed a great many elements of paramount importance to the evolution of Hindu civilisation, which is, like all other great civilisations, a composite creation, and that in certain matters the Dravidian and the Austric contributions are deeper and more extensive than that of the Āryan. The Dravidians appear to have brought to India from their original homeland in the islands of the Aegean and the tracts of mainland along the Aegean sea — Greece and Asia Minor, the conception of a Great Mother-Goddess and her male counterpart a Father-God on which the Siva-Uma cult of Hindu India grew up. The puja form of worship has been suggested to be of Dravidian origin. The cultural world of India has among its material and ideological bases some fundamental things derived from the Austric speaking Proto-Australoids. Certain magico-religious rituals, like the removal of the evil eye, by the rite which is known in Northern India as *nichhawar* or *baran*, which has a strong place in Hindu Society, would seem to be Austric in origin. Another trait derived from them is the idea of taboo. The germs of the idea of transmigration and some of the fundamental cults and rituals would probably go back to this source. In the domain of myth and legend, the legends of the creation of the world from an egg or eggs, of Nagas as the serpent spirits of the waters and the underworld and many more which do not form part of Āryan or the Indo-European inheritance in Hinduism, and do not seem to have come from the Dravidian world either, can reasonably be expected to have been derived from the Austric or Proto-Australoid world." ¹⁰

The Harappā relics give us some clues with regard to the religion of the Indus Valley Civilisation. "The numerous figurines of women suggest that there was some worship of a Mother-Goddess in which these figures played their part in household shrines, and there is a sealing which bears a representation of a female from whose womb a plant issues and suggests the idea of an earth-goddess concerned with vegetation. This is not the only link with contemporary Hinduism. There is more than one

representation on the seals from Mohenjo-dāro and Harappā of a male god, horned and three faced, sitting in the posture of a yogi, his legs bent double, heel-to-heel, and surrounded on one seal by four beasts, the elephant, the tiger, the rhinoceros and the buffalo, with a couple of deer at the throne at his feet. There can be little doubt that we have here the prototype of the great god Siva, as the Lord of the Beasts and Prince of Yogis. There is also evidence of some form of phallic worship, with representation of male and female generative organs; of tree-worship in which a deity is shown in the branches of the sacred fig-tree or pipal, still regarded as a holy tree. The seal representations again show what must be sacred animals, such as the humped bull. The one or two seals on which a hero is shown defeating tigers or other beasts suggest comparison with the Sumerian hero who battles with lions, Enkidu or Gilgamesh, and here perhaps there may be evidence of a faint strain of common tradition or even Sumerian influence in religious matters during the time of the flourishing Harappā culture. But, on all counts, the religion as implied from the archaeological remains, is significantly distinct from any others known in Western Asia, and is essentially Indian from the start." "The links between the Harappā religion and contemporary Hinduism are of course of immense interest, providing as they do some explanation of those many features that cannot be derived from the Aryan traditions brought into India after, or concurrently with the fall of Harappā civilisation. The old faiths die hard; it is even possible that early historic Hindu society owed more to Harappā than it did to the Aryan invaders."¹¹

That this surmise is correct is shown by the fact that these very same religious beliefs are met with in the Atharva-veda. The Harappā civilisation came to an abrupt close owing to conquest of the Aryans. "Clearly, after the first 'drastic Aryanisation' of the Punjab, some sort of *modus vivendi* was arrived at; if not there, eastwards in the Ganges basin as the frontier receded eastwards, and Harappā ideas permeated the religious thought of the Brahmanas."¹² The religion of the Atharva-veda resembles that of the Harappā culture so much that one is forced to the conclusion that it was taken over from the people of the Indus Valley Civilisation. "In spirit, however, the Atharva-veda is not only entirely different from the Rigveda, but represents a much more primitive stage of thought. While the Rigveda deals almost exclusively with the higher gods as conceived by a comparatively advanced and refined sacerdotal class, the Atharva-veda is, in the main, a book of spells and incantations

appealing to the demon-world and teems with notions about witchcraft current among the lower grades of the population and derived from immemorial antiquity." ¹³ The lower grades of the population must refer to the Dāyus and Dāsas of the Vedas, whom we have identified with the people of the Indus Valley Civilisation. As this civilisation antedates the Vedic period by at least 1,000 years and as the Proto-Australoids and Dravidians, who formed the bulk of the Harappā population, are, as we have seen, the oldest inhabitants of India, these notions may be aptly described as derived from immemorial antiquity.

A good idea of the range of animistic beliefs prevalent at the time of the Vedas can be obtained from a study of the beliefs prevalent in the 6th century B.C. in the valley of the Ganges, as recorded in early Buddhist literature. Quoting a passage from the *Silas*, Rhys Davids says : "there then follows a long enumeration, most valuable to the historian, of all kinds of animistic hocus-pocus, evidently forming part of the beliefs of the people in the valley of the Ganges in the sixth century B.C. We are told of palmistry, divination of all sorts, auguries drawn from the celestial phenomena, prognostications by interpretations of dreams, auguries drawn from marks on cloth gnawed by mice, sacrifices to Agni, oblations of various sorts to gods, determining lucky sites, repeating charms, laying ghosts, snake-charming, using similar arts on other beasts and birds, astrology, the power of prophecy, incantations, oracles, consulting gods through a girl possessed or by means of mirrors, worshipping the great one, invoking Siri (the goddess of luck), vowing vows to gods, muttering charms to cause virility or impotence, consecrating sites and more of the same kind. It is a queer list ; and very suggestive both of the wide range of animistic superstitions, and of the proportionate importance, then and to the people at large, of those particular ones included in the Veda." ¹⁴ Even today in villages and other parts of India all these animistic beliefs are found to exist in full life and vigour.

We have seen that many elements in medieval and modern Hinduism are foreshadowed by the religious cults of the older civilisation. Similarly, there are many elements in modern Indian medicine which cannot be traced to classical medicine but must have been derived from Vedic or pre-Vedic medicine. "Never, probably, in the history of India was there any time when people did not take to charms and incantations for curing diseases or repelling calamities and injuring enemies. The Rīgveda itself may be regarded in a large measure as a special development of such magic rites. The hold of the Atharvanic charms on the minds

of the people was probably very strong, since they had occasion to use them in all their daily concerns. Even now, when the Rigvedic sacrifices have become extremely rare, the use of Atharvanic charms and of their descendants, the Tantric charms of comparatively later times, is very common amongst all classes of Hindus. Amulets are used almost as freely as they were used three or four thousand years ago, and snake charms and charms for dog bite and others are still prevalent. Faith in the mysterious powers of occult rites and charms forms an essential feature of the popular Hindu mind, and it oftentimes takes the place of religion in the ordinary Hindu mind."¹⁵ Whence then did these medical beliefs emanate? They might have persisted from the primitive medicine of the prehistoric inhabitants of India, or they might have been derived, as the religious beliefs were, from the inhabitants of the Indus Valley Civilisation. We have direct evidence with regard to the borrowing of religious beliefs, in the relics of that civilisation discovered at Harappā and other places in the Indus valley, but we have no such evidence with regard to these medical beliefs. As the Indus Valley Civilisation was contemporaneous with those of Mesopotamia, Egypt and Crete and as there was intimate contact between them all, a study of the medical beliefs of these nations would afford us some clue to the problem. The Egyptians believed that disease and death were not natural and inevitable, but caused by some malign influence which could use any agency, natural or invisible, and very often belonged to the invisible world. Often it is a god, a spirit or the soul of a dead man that has cunningly entered a living person, or that throws itself upon him with irresistible violence. The physician had two important duties. He must first discover the nature of the spirit in possession and then attack it, drive it out or even destroy it. He could only succeed by powerful magic; so he must be an expert in reciting incantations, and skilful in making amulets. Diseases were believed to be due to hostile spirits, or caused by the anger of a god, so that medicines, no matter how powerful, could only be expected to assuage the pain; but magic alone — incantations, spells and prayers — could remove the disease. One department of Egyptian medicine reached a high stage of development, viz. hygiene. The Egyptians also introduced the use of secretions and parts of the animal body as medicines. They also deified their medical men. In Mesopotamia also medicine was ancillary to religion. Disease was believed to be due to evil spirits or demons, and was treated with incantations. The art of divination was introduced into medicine by the Mesopotamians. Their second

contribution was the supposed influence of the heavenly bodies upon man's welfare. Their third was medical ethics. The contributions of Crete were hygiene, temple medicine, and the cult of the serpent deity. As will be shown in the following chapters, ancient Indian medicine was magico-religious and possessed all the characteristics of the systems used by the contemporaneous civilisations. As in the case of the persisting religious beliefs, these medical beliefs also, persisting from the time of the Atharva-veda, were most probably derived from the Indus Valley Civilisation, which must have shared them with the contemporaneous civilisations of Mesopotamia, Egypt and Crete.

The excavations at Harappā and Mohenjo-dāro bear ample evidence to the proficiency reached by the people of the Indus Valley Civilisation in matters of sanitation and hygiene. Both Harappā and Mohenjo-dāro appear to have been built to a careful plan. These two cities between them represent the oldest examples of town-planning in the world. Anyone who strolls through their ruins can see that the houses which once stood there were provided with all modern conveniences. No amenity was lacking. There were baths, lavatories, drains, fresh water tanks, handsome interior courtyards, comfortable bedrooms, etc. The main drains could be cleared by lifting large, specially made brick man-hole covers, and the whole conception shows a remarkable concern for sanitation and health without parallel in the Orient in prehistoric past or at the present day. Soakage pits took the eventual sewage.¹⁶ "The importance, not necessarily the deification, of water in the life of the Harappans is stressed by the Great Bath on the citadel of Mohenjo-dāro and by the almost extravagant provision for bathing and drainage throughout the city, and may provide another link with the later Hinduism."¹⁷

VEDIC MEDICINE — MAGICO-RELIGIOUS MEDICINE

Our knowledge of the medicine of the Vedas is derived from two Vedas, the Rigveda and the Atharva-veda. Occasional references to diseases and their cures are to be found scattered in Rigvedic texts. It is to the Atharva-veda that we are mainly indebted for our knowledge of Vedic medicine. Atharva-vedic medicine is an amalgam of religion, magic and empirico-rational elements. "The religion of the Atharva-veda is that of the primitive man, to whom the world is full of shapeless ghosts and spirits of death. When he realises his helplessness against the natural forces, the precariousness of his own existence so constantly subject to death, he makes death and disease, failure of

monsoon and earthquake, the play-ground of his fancy. The world becomes crowded with goblins and gods, and the catastrophes of the world are attributed to dissatisfied spirits. When a man falls ill, the magician and not the physician is sent for, and he employs spells to entice the spirit away from the patient." ¹²

Primitive man regards everything he cannot explain as the work of a god. To him the abnormal, the unusual, is divine. The uncharted region of mysterious phenomena is the realm of supernatural forces. "It is the work of heaven" is a sufficient answer when the human intelligence can give no satisfactory explanation. He is ever ready to see in any disease the manifestation of supernatural power. To the Atharvan this power was generally one of the hosts of demons by which he believed himself surrounded. These demons of disease are vague in outline and indefinite in number and were known by the names *pisacha*, *rākshasa*, *atrin* and *knava*. It is the pernicious activities of these demons that produce diseases. The Atharva-veda makes very little difference between demons and sorcerers and therefore it is not surprising to find the latter causing disease or to find sickness attributed to magic, curses or the evil eye. Some diseases are attributed to the greater gods, and this often as a punishment for sin. Varuna sends dropsy to punish crime and especially falsehood. Certain sharp pains are ascribed to the spear of Rudra and he is also supposed to send the *takman*; diarrhoea is connected with the arrows of Parjanya (the rain god). Agni is regarded as producing fever, headache and cough. Takshaka, a serpent god, is worshipped, and there are charms to cure the bites of poisonous reptiles. Vedic medicine thus believed that diseases were caused by possession by evil spirits, anger of certain gods, by evil deeds, and the sorcery of enemies. The Atharva-veda deals with the treatment of disease (*chikitsa*) by advising propitiatory rites (*swāstyana*), offerings (*bali*), auspicious oblations (*mangala homa*), penances (*niyama*), purificatory rites (*prāyas-chitta*), fasting (*upavasa*) and incantations (*mantras*). This is the reason why the Atharva-veda is mainly a book of spells and incantations appealing to the demon world. "The hymns of the Atharva-veda are couched in terms of imprecations against demons, sorcerers, enemies; of charms for expelling diseases wrought by demons or sent by the gods as punishment for man's sins; of incantations intended to impart health, longevity, success and victory, sex-attractiveness and manly vigour. In the Vedas these are supplemented by amulets, medicines, philters, and other devices of witchcraft and magic." ¹³

In the Atharva-veda magic eclipses everything and reigns sup-

reme. The wizard is greater than the gods; his herbs and amulets are sovereign remedies.

In Vedic medicine there is not as yet a marked difference between diseases and demons. Therefore, it is difficult to identify the diseases mentioned in the Atharva-veda. There is nothing that can be called diagnosis in our sense of the term. The physician is concerned merely with the troublesome symptoms. Sometimes the symptom is definite enough to enable us to identify the disease, e.g. dropsy: more frequently, however, it is not. The principal diseases which occur in Vedic medical texts, more or less clearly discernible in their nature and relation to those mentioned in subsequent classical tradition are: fever (*takman*), diarrhoea (*āsrāva*), cough (*kāsa*), consumption (*balāsa*, *yakṣma*), dropsy (*jalodra*), tumour (*akṣata*), leprosy and skin diseases (*kilāsa*), inherited diseases (*kṣetriya*), and seizures by various demons.

In the Atharva-veda itself only a few medicines are mentioned, such as jangida, gulgulu, kuṣṭha, and sata-vāra, and these are all to be used as amulets for protection, not only from certain diseases but also from the witchcraft of enemies. The effect of these herbs was of the same miraculous nature as that of mere charms or incantations. They are not supposed to operate in a natural or rational manner but in a supernatural way. In most of the hymns which appear as pure charms, the Kausika sūtra of the Atharva-veda, directs the use of various medicines either internally or as amulets. Medicines were really considered as internal amulets.

Though the Atharva-veda deals with charms, prayers and imprecations against demons, sorcerers and enemies, it contains many empirico-rational elements. In addition to the charms and amulets and the herbs which were taken internally, water was considered to possess great medicinal and life-giving properties. There are many hymns which praise these qualities of water. The medicinal properties of herbs were often regarded as being due to water, which formed their essence. Next in prominence to the plants were the products of the cow, which as partaking of its holiness, were used either for their own efficacy or as a suitable vehicle for the remedies. Butter, curds, milk, butter-milk, cow-dung, cow-urine were all used. The *panchagavya* (five products of the cow), which afterwards became a potent panacea was not yet concocted, though all its ingredients were in use. Food of any sort served as a vehicle, but porridges, especially rice porridges, were employed most frequently. Honey and fat were also prescribed.

Of practices of real therapeutic value, the Kausika sūtra of the Atharva-veda contains but little. The most delicate is the probing of the urethra, which seems to be prescribed in XXV. 15.16, for the relief of one suffering from retention of urine. A similar instance (at a later period) of the evolution of a practical out of a magical proceeding is the giving of an enema as a substitute for an operation. The application of leeches to sores is found in XXX. 16. A torch is applied to the bite of a serpent. The original intention must have been symbolic, but the result may have been some sort of cauterisation.

The medical lore contained in the Atharva-veda is not inconsiderable. We have in X. 2, a hymn entitled: "The Wonderful Structure of Man" in which the several parts of the skeleton are carefully enumerated. In II. 33, almost all the important organs of the body are enumerated. In VIII. 7, we have a hymn which gives a very good summary of their knowledge of herbs. It is a charm bestowing longevity; the divinities to whom it is addressed are the herbs mentioned in the hymn. In X. 8.43, a reference is made to a lotus with nine gates. The comparison of the heart to a lotus is very common in Sanskrit literature. In I. 17.3, we read "Thou *sira* of the lower part, remain; thou of the upper part remain; so thou of the middle part, so thou small, so thou big *dhamani*." With regard to this verse, Bolling remarks: "the apparent distinction between veins (*sira*) and arteries (*dhamani*) in I. 17.3, is offset by the occurrence of the same words in VII. 35.2, with the more general sense of internal canals meaning entrails, vagina, etc., showing how vague were the ideas held with regard to such subjects."²⁰ "But this is not correct" writes Dasgupta, "for there is nothing in I. 17.3, which suggests that a knowledge of the distinction between veins and arteries, in the modern sense of the terms, was known at that time. The division of *dhamanis*, *siras*, and *snavas* seems to have been based on their relative fineness; the thicker canals were called *dhamanis*, the finer ones were called *siras*, and the still finer ones *snavas*. Their general functions are considered more or less the same."²¹ There is a mention of the general flow of certain fluids in the body. In X. 2.11, we read: "who stored in him floods moving in all diverse directions and formed to flow in rivers pink, rosy red, and coppery dark running in all ways in a man, upward and downward..." The intimate relation between the heart and the brain seems to have been dimly apprehended. Thus it is said, "together with his needle hath Atharvan sewn his head and heart." The theory of the *vāyus*, which we find in all later

literature, is alluded to, and the *prāna*, *apāna*, *vyāna*, and *samāna* are mentioned in I. 2.13. The *ojas*, with which we are familiar in later medical works, is mentioned in II. 18, where Agni is described as being *ojas* and is asked to give *ojas* to the worshipper.

Bolling, discussing the Atharvan practice of medicine, writes : "To be noted, however, is the fact that the Hindu theory of the constitution of the body of three elements, bile, phlegm and wind, does not appear in the early Atharvan texts." ²² But Dasgupta quotes I. 12.3, where diseases are divided into three classes, viz., those produced by water or by wind, and those which are dry (*yo abharaajā vātaajā yas ca suṣmah*). He contends that this classification of diseases corresponds to the later classification of all diseases as being due to the three *doṣas*, viz., *vāyu*, *pitta* and *kapha*.

The most prominent feature of the Atharva-veda is the multitude of incantations it contains. These are pronounced either by the person who is himself to be benefited or more often by the sorcerer on his behalf. So the practice of medicine was in the hands of the priests or sorcerers. The functions of priest and physician were combined in one and the same person. He may be called the priest-physician, the Atharvan. He had many duties to perform. He gained access even to kings in the capacity of adviser. In fact, he was physician, priest, sorcerer and adviser to the king all combined.

Vedic medicine was not so much primitive medicine as magico-religious medicine. Sigerist distinguishes these two kinds of medicines. "In primitive medicine, magical, religious and empirico-rational elements are inextricably combined, whereas in magico-religious medicine though these elements are frequently combined, a separation takes place." ²³ In Vedic medicine we notice this separation between the magico-religious elements and the empirico-rational elements. In A.V. II. 9.3, we read that there were hundreds of medical practitioners and thousands of herbs, but what can be done by these can be effected by binding an amulet with the particular charm of this verse. Thus it would appear that the practice of pure medicine by professional medical men had already begun. Again in A.V. II. 9.5, the Atharvan who binds the amulet is described as the best of all doctors. Again in A.V. VIII. 7.26, we read : "In how many herbs the human physician finds a remedy, so many, all remedial, do I bring to thee." Thus it would appear that even at the time of the Atharva-veda there were physicians and an elaborate pharmacopœia treating diseases with drugs. The praise of the Atharvan

as the physician *par excellence*, superior to all medicines prescribed by other physicians, implies the existence of two systems of medicine side by side: (1) the system of charms prescribed by the Atharvan (priest-physician); and (2) the system of drugs prescribed by ordinary medical practitioners. The existence of doctors using herbs, not operating like the charms in a supernatural way but in a rational way, marks the beginning of the separation of empirico-rational medicine from the magico-religious medicine of Vedic times.

POST-VEDIC MEDICINE

Post-vedic medicine is divisible into two periods; the first extending from the completion of the collection of the vedic hymns (800 B.C.) to the rise of medical schools (600 B.C.); the second from the rise of the medical schools to the end of classical Indian medicine.

It is now supposed that the hymns of the Rigveda were composed between 1500 and 1200 B.C. and that the collection of the vedic hymns in their present form was completed by 800 B.C. The schools of Ātreya and Dhanvantari are supposed to have been established in the 6th century B.C. The two centuries (800-600 B.C.) intervening between the completion of the collection of the vedic hymns and the rise of the medical schools is occupied by the period of the Brāhmanas and the Upanishads. We have no medical records to enlighten us as to the state of medicine during this period. We have to gather our information from non-medical sources such as the Brāhmanas and the Upanishads. The Gopatha-Brāhmana, the Brāhmana of the Atharva-veda, mentions among other Vedas, Sarpa-veda, Pisācha-veda, Asura-veda, perhaps in the sense of Upa-vedas.²⁴ But no mention is made of the Āyurveda, showing that at that time this was not yet known. The Chāndogya Upanishad, which is later than the Gopatha-Brāhmana, mentions among the subjects of study pursued in those days, the Atharva-veda, Sarpa-vidyā, Pitriya-vidyā, and Bhūta-vidyā. Here also Āyurveda is not mentioned.²⁵ Susruta, giving details of the demons concerned in Bhūta-vidyā, mentions Devas, Asuras, Pisāchas and the spirits of the ancestors (Pitriyas).²⁶ These are the names of the vedas and vidyas mentioned in the Gopatha-Brāhmana and Chāndogya Upanishad. So it may be inferred that in the Brāhmana-Upanishad period, the centuries following the Atharva-veda, i.e., between 800 and 600 B.C., medical studies appear to have been confined to Bhūta-vidyā and Sarpa-vidyā. These two were

contained in the Atharva-veda. Besides these, we have in the Atharva-veda, charms, amulets, and medicines for securing long life, increasing virility, *rasāyana* and *vājīkaraṇa*. So it would appear that in the period of the Brāhmanas and the Upanishads medicine had not evolved very much and was mainly magico-religious in character. Side by side with this medicine, empirico-rational medicine also evolved, though very slowly. We have noticed in dealing with vedic medicine that many of its beliefs can be traced to the Indus Valley Civilisation, which shared them with the contemporaneous civilisations of the ancient world. "Yet in each of these places (basins of the Nile and the Euphrates, the Ganges and the Yellow River)", says Rhys Davids, "though there was a real and progressive civilisation, and the ideas and customs were no doubt constantly changing and growing, there was a dead level, if not a complete absence, of what we should call philosophical thought. The animistic hypothesis, the soul-theories of their savage ancestors seemed sufficient, even to the progressive races, to explain all that they saw and felt. Then, suddenly and almost simultaneously and almost certainly independently, there is evidence, about the 6th century B.C., in each of these widely separated centres of civilisation, of a leap forward in speculative thought, of a new birth in ethics, of a religion of conscience threatening to take the place of the old religion of customs and magic. In each of these countries similar causes, the same laws regulating the evolution of ideas had taken just about the same number of centuries to evolve out of similar conditions, a similar result."²⁷

In India also the same phenomenon was noticeable. The age of the Brāhmanas and the Upanishads (800-600 B.C.) has been designated an epoch of mental ferment in Indian history. Of this epoch the 6th century B.C. was particularly important as a time of great intellectual ferment and spiritual revolt, leading to the establishment of the new faiths, Jainism and Buddhism. This was also the age of a quiet philosophical movement which gave rise to the six systems of Indian philosophy : the Sāṃkhya, Yoga, Nyāya, Vaiśeṣika, Mīmāṃsa and the Vedānta. "The earliest beginnings of most systems of Hindu thought can be traced to some time between 600 and 100 B.C. It is extremely difficult to say anything about the relative priority of the systems with any degree of certainty. It is possible that the earliest speculations of some form of Sāṃkhya, Yoga and Mīmāṃsa were prior to Buddhism, though the elaborate works on these systems which we now possess, are later than Buddhism. The Vaiśeṣika system is also probably pre-Buddhistic."²⁸

Medicine was not unaffected by these movements of philosophic and religious thought. We have seen that in the Atharva-veda there were two contending systems of medicine : the system of charms and that of drugs. A separation between the two was already discernible. In the Atharva-veda the system of charms was predominant, and while that of drugs held a subordinate position. Eventually the system of drugs seems to have broken loose from that of charms and begun to develop independently. The system of charms may be designated magico-religious medicine and that of drugs empirico-rational medicine. The transition from the former to the latter must have taken place during the period of the Brāhmanas and Upanishads, i.e., between 800 and 600 B.C. From the evidence of the Brāhmanas and Upanishads it appears that the medicine of this period consisted of *Bhūta-vidyā*, *Sarpa-vidyā* (dealing with poisons), *Rasāyana* and *Vājīkarana*. It was dominated by demonology. But some time before the rise of the medical schools we find a definite change has taken place in it. Both Charaka and Susruta describe Āyurveda as an *upāṅga* or an *upa-veda* connected with the Atharva-veda and acknowledge it as the source of their medical knowledge. So the Āyurveda must have been in existence prior to the establishment of the schools of Ātreya and Susruta. Āyurveda consisted of eight divisions (*aṣṭāṅga*), viz., the Salya-tantram, the Sālākya-tantram, the Kāya-chikitsā, the Bhūta-vidyā, the Kaumāra-bhṛtya, the Agada-tantram, the Rasāyana-tantram, and the Vājīkarana-tantram.²⁹ It would be noted that, of these eight divisions, four are common to both the Āyurveda and the Atharva-veda ; viz., Bhūta-vidyā, Agada-tantram (*Sarpa-vidyā* or toxicology), *Rasāyana-tantram* and *Vājīkarana-tantram*. During the transition period four new divisions come into existence ; viz., Salya, Sālākya, Kāya-chikitsa, and Kaumāra-Bhṛtya and are allied to the Āyurveda. While in the Atharva-veda, demonology was predominant, in Āyurveda Bhūta-vidyā forms only one of the eight divisions. Medicine is no longer magico-religious but has become empirico-rational. This change is to be attributed to the influence of the new schools of philosophy. Medicine has at last broken its leading strings to religion and allies itself with philosophy. The tradition of an *aṣṭāṅga* Āyurveda or a science having eight branches must have been established at this time.³⁰ This marks the close of the animistic period in ancient Indian medicine.

Tradition traces medicine from a mythical, through a semi-mythical, to a historical beginning. According to this tradition, Indra taught the science of medicine to Ātreya and the science

of surgery to Dhanvantari. This may be taken to mean that Ātreya, the physician, and Susruta, the surgeon, were understood to be the first founders in their respective departments of medicine as a science. "According to another, non-medical, line of Indian tradition, preserved in the Buddhist Jātakas, there existed in the age of Buddha two great universities or seats of learning, in which all sciences including medicine were taught by professors of world-wide renown. These two universities were Kāsi or Benaras, in the East, and the still famous Takṣasilā or Taxila, in the West. In the latter university, in the time of Buddha or shortly before it, the leading professor of medicine was Ātreya. He accordingly should have flourished at some time in the 6th century B.C. As one of the names of Susruta's teacher is Kāsirāja, King of Kāsi, he may not unreasonably refer to the University of Benaras or Kāsi. This would place the origin of surgery as a science in the east of India."³¹ From this time onwards the systematic development of Indian medicine proceeded primarily on two principal lines, one that of Ātreya and the other that of Susruta.

Ātreya taught medicine to six disciples : viz., Agnivesa, Bhela, Jatakarna, Parāsara, Kṣirapāni and Hārīta, each of whom wrote a treatise on medicine. These were known as tantras, and there is evidence to show that they were in existence till at least the 2nd century A.D. Similarly, Dhanvantari taught surgery to six disciples : Aupadhenava, Aourabhara, Poushkalavata, Gopurarakshita, Bhoja, and Susruta, each of whom wrote a tantra on surgery. These tantras constitute the earliest medical literature and formed the basis of teaching in the medical schools. Charaka refers to the existence of various schools of medicine and various treatises on medicine before his time. Mentioning that various treatises on the profession of physician were in circulation, he then discusses the essentials of a good treatise on medicine. He also mentions that diversity of views with regard to medical theories existed.³² It was the existence of these diverse treatises expressing diverse opinions on medicine that called for the systematisation of the then existing medical knowledge. The various *samhitas* are attempts to accomplish this task. Thus, following the tantra period we have the *samhita* period.

The *samhita* period may be called the creative period of Indian medicine. We have three important *samhitas* : the Charaka, Susruta and Bhela. The Bhela *Samhita* has come down to us in an imperfect and corrupt form. These *samhitas* of Charaka and Susruta form the classics of ancient Indian medicine. The medical schools of Charaka and Bhela conform to the tradition of

an *aṣṭāṅga* Āyurveda. Their treatises consist of eight divisions but they differ essentially as to the contents of these divisions. The divisions are : Sūtra, Nidāna, Vimāna, Sārira, Indriya, Chikitsa, Kalpa and Siddha sthānas. In the surgical school this tradition was not adhered to. Susruta's original tantra contained only five divisions : Sūtra, Nidāna, Sārira, Chikitsa and Kalpasthānas. Later, Susruta, the junior, added an Uttara-tantra consisting of the divisions : Sālākya, Bhūta-vidyā and Kaumārabhṛtya. Thus Susruta's treatise was made to conform to the traditional *aṣṭāṅga* Āyurveda. Both the Vāgbhaṭas follow the example of Susruta Samhita and their works contained six sections comprising Sūtra, Nidāna, Sārira, Chikitsa, Kalpa and Uttara-sthāna and not an Uttara-tantra.

"The Charaka Samhita stands as the finest document of the creative period of ancient Indian medicine (600 B.C. - 200 A.D.), in regard to the extent of its contents and to the state of its preservation. It consists of an enormous number of chapters (lessons), which overlap in content, thus bearing witness to the fact that its classic rendering grew out of a vast amount of floating tradition, consisting of monographs (*kalpas*), single prescriptions and specialised treatises (*tantrās*), transmitted separately and in groups. It marks the culmination of a creative period. The rich inheritance from the preceding generations is carefully gathered, sifted, and brought into a definite, comprehensive form. Charaka is the most rewarding author among the writers of classic medicine ; he excels Susruta and Vāgbhaṭa by far, in regard to the philosophic background of medicine and its interrelation with religious thought and the various aspects of Hindu spiritual life and ideals." ³³

Charaka at the very commencement of his samhita succinctly defines the meaning and scope of Āyurveda as conceived in the school of medicine. Āyurveda is called the science of life. Good, evil, happy and unhappy is life. The science which declares its nature, and measure, and what is beneficial and what injurious to it is called the science of life. The union of body, senses, mind and soul constitutes life, is animate and is called Puruṣa (person or being). It is regarded as the subject in which health and disease co-inhere, parity of correlation being the cause of health.

The doctrine of the human body, as well as the greater part of diagnosis and therapy in classical medicine, is based on the conception of certain constituents or elementary substances, (*bhūtas* and *dhātus*) which pervade the organism and maintain its functions. The body was considered a conglomeration

(*samudāya*) of the modification of the five elements (*bhūtas*), water (*āp*), fire (*tejas*), air (*vāyu*), earth (*prithivī*), and ether (*ākāś*). The modifications of these five elements (*bhūtas*) which cooperate together to uphold the body were called *dhātus* (the constituents of the body). The body functions properly so long as these *dhātus* are in proper proportions in it. When the *dhātus* are in their normal measure they are said to be in equilibrium and this state is called *dhātu-sāmya* or health. When the normal measure of the *dhātus* is either increased, or decreased, their equilibrium is upset and this state is called *dhātu-vaiśāmya* or disease. Diseases are caused through the excess, deficiency and wrong administration of sense-objects, the climatic characteristics of heat and cold and the misuse of intelligence.

The sole aim of Āyurveda is to prescribe diet, medicines and a regimen of life such as, if properly followed, will enable a normally healthy man to maintain the equilibrium of his *dhātus* and one who has lost this equilibrium to regain it, i.e., to advise man how to preserve or secure health (*dhātu-sāmya*).

Diet was considered the most important agent in causing the loss of harmony of the *dhātus*. The use of beneficial food is the only cause of the growth of a person ; while the use of injurious food is the cause of disease. So diet was important both in health and disease.

The regimen of life to be followed was considered equally important. It consisted of detailed regulations for daily life (*dīna charya*) and also for the control of mind and conduct. The daily regimen of a healthy person ought to be such as to maintain the equilibrium of the *dhātus*. Life has for its root beneficial practices ; from a course of contrary practices results death.

Treatment was adopted with a view to perpetuate the harmony of the *dhātus*, to prevent them from becoming inharmonious and to bring them back to their normal state of equilibrium when disturbed. Ascertaining through the disturbance of the *dhātus*, the physician should treat diseases that are curable with medicines, diet and a regimen of life, each possessed of virtues contrary to the cause, to the disease or to both cause and disease, reflecting the while upon the question of measure and time.

“Āyurveda as it evolved in the Ātreya school of medicine and as recorded in Charaka Samhita contains no section on surgery. Associated primarily with warfare, surgery for a long time remained a special branch distinct from the civil science of medicine and had not yet been incorporated into the encyclopaedic tradition represented by Charaka Samhita. It needed a particular

effort, a stroke of genius, to break down the barriers of traditional specialisation, and to merge surgery into the science of medicine. This step is accomplished through the work of Susruta. In Susruta Samhita surgery has achieved a leading position as an indispensable element of general medical training. One may say his emphatic statement of its incomparable value for the correct understanding of anatomy reflects a triumph in the evolution of Indian medicine. There is nothing to indicate that surgery was relegated to an inferior place, though it had been handed down as a separate tradition from that of the Āyurveda before Susruta. "The contrary is true."³⁴ Susruta recommends that every student of medicine must be taught both medicine and surgery. So also Charaka recognises surgical treatment as an integral part of treatment in general.

CLASSICAL MEDICINE AND THE SCHOOLS OF PHILOSOPHY³⁵

Āyurveda is largely indebted to the Nyāya-Vaiśeṣika and the Sāṃkhya schools of Indian philosophy for its philosophical ideas. "Charaka in Sārira Sthāna gives a detailed description of the school of Sāṃkhya but this does not seem to have much bearing on the needs of Āyurveda and the whole chapter does not appear to fit in with the rest of the work and it is not referred to in the other parts of the book. It is not improbable that this chapter was somehow added to the book from some other treatise. Besides Charaka's account of Sāṃkhya is quite different to the traditional account given in Iśvara-Krishna's Kārika and in the Sāṃkhya-sūtra and seems to be one of the earliest versions of the Sāṃkhya. The relation of Nyāya-Vaiśeṣika with Charaka is very close in spite of many modifications. Susruta does not, like Charaka, enumerate the categories of the Vaiśeṣika and his account of Sāṃkhya is very faithful to the traditional account given in Iśvara-Krishna's Kārika and in the Sāṃkhya-sūtra." We are specially concerned with the Nyāya-Vaiśeṣika school, as Charaka's whole medical theories are based on it.

The Vaiśeṣika system is generally found synthesised with that of Nyāya and the system has therefore come to be known as Nyāya-Vaiśeṣika. The distinguishing feature of Nyāya is its belief in the utility of analysis and the reliability of reason. It is both logic and dialectics. The main aim of Vaiśeṣika is metaphysical. The Nyāya Vaiśeṣika believes that the existence of the external world, although necessarily known through the mind, is in no way dependent on it. Owing to this belief in the

independent existence of the external world, the system is described as realistic. The doctrine also holds that ultimate reality is many, and it is therefore described as pluralistic.

THE MAIN DOCTRINES OF NYĀYA-VAISESIKA SCHOOL

This system depends solely on experience and reason. As already mentioned, it is a pluralistic system which neither tries to reduce the diversity of experience to any universal principle, nor dismisses patent facts of experience to fit the demands for logical coherence of mere abstract thought. The entities it admits are taken directly from experience.

It admits of six original categories (*padārthas*) of which all things in the world are made up. These are : Dravya, Guna, Karma, Sāmānya, Viśeṣa and Samavāya.

1. Dravya. By Dravya is meant substance, which is independent by itself. The other entities such as Guna (quality), Karma (action), Sāmānya (sameness or generality), Viśeṣa (speciality or specific individuality) and Samavāya (the relation of inherence) cannot appear without the existence of Dravya (substance). Dravya is thus the substratum (*āśraya*) on which all the others depend. The dravyās are nine : earth (*kistī*), water (*ap*), fire (*tejas*), air (*mārut*), ether (*ākāśa*), time (*kāla*), space (*dik*), soul (*ātman*), and mind (*manas*).

2. Gunas. Gunas in Vaiśeṣika mean qualities and not subtle reals or substances as in Sāmkhya-Yoga. Eighteen gunas are enumerated : rupa (colour), rasa (taste), gandha (odour), sparsa (touch), sabda (sound), samkhya (number), parimiti (measure), prathaktva (mutual difference or separateness of things), sam-yoga (connection), vibhāga (separation), paratva (priority), aparatva (posteriority), buddhi (knowledge), sukha (happiness), dukkha (sorrow), ichha (desire), dveṣa (antipathy) and yatna (effort). This list of qualities is referred to as the prayatnāntha list.

3. Karma. Karma means movement. It is the third thing which must be held to be an irreducible reality, with dravya and guna. Five kinds of movement were recognised, viz., upward, downward, contraction, expansion and movement in general. All kinds of karmas rest on substances, just as the gunas do, and cause the things to which they belong to move.

4. Sāmānya is the fourth category. It means the genus or aspect of generality or sameness that we notice in things. All perception as sameness of a thing is due to the presence of this in it.

5. *Viṣeṣa*. Through *Viṣeṣa* things are perceived as diverse.

6. *Samavāya*. The inseparable relation of inherence is a relation by virtue of which two different things such as substance and attribute, substance and karma, substance and *sāmānya*, *kāraṇa* (cause), *kārya* (effect), atoms, *viṣeṣa*, appear so unified that they represent one whole or one identical inseparable reality. This peculiar relation of inseparable inherence is the cause why substance, action and attribute, cause and effect and *jāti* in substance, and attribute appear as indissolubly connected as if they are one and the same thing.

The *Charaka Samhita* begins with an enumeration of the *Vaiśeṣika* categories, and though it often differs from the *Vaiśeṣika* view, it seems to take its origin from the *Vaiśeṣika*. It admits all the six *pradārthās* of *Vaiśeṣika*, viz., *dravya*, *guṇa*, *karma*, *sāmānya*, *viṣeṣa* and *samavāya*. It defines *dravya* (substance) as that which possesses quality (*guṇa*) and action (*karma*) in relation to inherence and is also the inseparable material cause (*samavāyi kāraṇa*) of all effects. It enumerates the five elements (*bhūtas*), *manas*, time, space and self as the nine substances (*dravya*).

With regard to *gunas* (qualities), *Charaka Samhita* enumerates the sensible qualities, viz., sound, touch, colour, taste and smell. The mechanical or physical qualities are given in two lists, the *Gurvādayah* and the *Parādayah* lists. The *Gurvādayah* list consists of twenty qualities beginning with heaviness (*guru*); this list enumerates heavy (*guru*), light (*laghu*), cold (*śīta*), hot (*uṣṇa*), viscous (*snigdha*), dry (*rūkṣma*), inactive (*manda*), active (*tīkṣṇa*), motionless (*sthira*), fluid (*sara*), soft (*mṛdu*), hard (*katina*), clear (*visada*), slimy (*picchila*), smooth (*slakṣṇa*), rough (*khra*), bulky (*sthūla*), penetrative (*sūkṣma*), dense (*sandra*), liquid (*drava*), and intelligence (*buddhi*). It gives another list of qualities beginning with remoteness (*para*) and ending with habit (*abhyāsa*). The second list is called the *parādayah* list. The *gunas* enumerated in this list are *para*, *apara*, *yukti*, *sāmkhyā*, *samyoga*, *vibhāga*, *prthaktva*, *parimāṇa*, *samkāra* and *abhyāsa*. The *gurvādayah* list is not found in *Vaiśeṣika*. The *parādayah* list, as such, is not found in *Vaiśeṣika* but it contains many of the *gunas* enumerated in the *Vaiśeṣika pratyakṣa* list.

"It is worth mentioning that though the terms used are the same as in *Vaiśeṣika* yet they are used mostly in different senses in accordance, probably, with medical tradition. *Para* means superiority or importance; *apara* means inferiority or unimportance. This importance or unimportance is with reference to

country, time, age and measure. *Yukti* means proper selection of medicines with reference to certain diseases; *samyoga* means the mixing up or compounding of two or more substances; *vibhāga* means separation; *prthaktva* means difference; it stands for three kinds of difference, special difference, difference of characters and difference of identity due to numerical distinction; *Parimāna* means measurement by weight; *samskāra* means production of new qualities; and *abhyāsa* means habit due to constant practice."

"In the case of *sāmānya* and *viśeṣa*, again, Charaka seems to add a new sense to the words. In the *Vaiśeṣika* system the word *sāmānya* means a class concept; but in Charaka it means the concrete things which have similar constituents or characteristics; *viśeṣa*, which means in *Vaiśeṣika* ultimate specific properties differentiating one atom from another, means in Charaka concrete things which have dissimilar and opposite constituents or characteristics. *Sāmānya* and *Viśeṣa* thus have a significance quite different from what they have in *Vaiśeṣika* system. The principle of *Sāmānya* and *Viśeṣa* is the main support of *Āyurveda*; for it is the principle which underlies the application of and the course of diets. Substances having similar constituents or characteristics will increase each other and those having dissimilar constituents or characteristics will decrease each other. Thus a substance having the characteristics of *vāta* will increase *vāta* and decrease *śleṣman*, which is dissimilar to it and so on. *Sāmānya* is thus defined as *tulyārthata*, i.e. performing similar purposes. Instead of having only a conceptual value, *Sāmānya* and *Viśeṣa* are seen to discharge a pragmatic work of supreme value to *Āyurveda*." However, in spite of these modifications, the relation of *Nyāya-Vaiśeṣika* with Charaka seems to be close.

LOGIC AND DIALECTICS

We have seen that *Āyurveda* was indebted to *Vaiśeṣika* for its physical and metaphysical views. It was indebted to *Nyāya* for its logic and dialectics. Charaka, talking about diagnosis says that there are three especial means (*pramānās*) for this: (1) the instruction of the inspired or wise (*āptopadesa*), (2) perception (*pratyakṣa*), (3) inference (*anumāna*). *Nyāya* admits verbal testimony as an independent *pramāna* and does not restrict it to the Vedas, but also extends it to secular matters, defining it in general terms as the testimony of a trustworthy person (*āpta*), one who knows the truth and communicates it correctly. Charaka agrees with this view of testimony. With

regard to perception, Nyāya holds that for it to occur there must be contact of the self with manas, and manas with a sensory organ, and the sensory organ with an appropriate object. The same view was held by Charaka of the mechanism of perception. With regard to inference (*anumāna*) it was held to be of great importance. Āyurveda was occupied from the beginning with the investigation of the nature of causes (*hētu*) and reasons (*linga*) for legitimate inferences in connection with diagnosis and the apprehension of symptoms. Charaka holds that all three methods: the cause and effect relation (*nidāna*), the method of invariable prognostication (*pūrva-rūpa*), and the method of concomitant variation (*upasāya*, which includes *anupasāya* also) are to be employed either jointly or separately for the ascertainment of the nature of diseases which have already occurred or which are going to happen in the near future. Nyāya also describes *anumāna* as being of three kinds, viz. from cause to effect, from effect to cause and inference from similarities. It is essentially these three forms of inference that are described in Charaka Samhita, though different terms are used to denote them. Thus Charaka's view corresponds to that of Nyāya with regard to the number of *pramānas*, the mechanism of perception and the forms of inference.

Logic was of use with Indian medical men, not only in diagnosing a disease, but also in the debates which they had with one another. Rival practitioners often had to show their skill and learning in debates on the treatment of rich patients. The art of carrying on a dispute successfully was considered an important acquisition among medical practitioners. Thus we have a whole set of technical terms relating to disputes, such as are never found in any other literature, excepting the Nyāya-sūtra. In Charaka Samhita almost the whole of the chapter called the "Roga-bhīṣag-jitīya-vimāna" (C.S. III. 8) is devoted to this subject. The Nyāya is sometimes called *Tarka-vidyā*, the science of debate, or *vādavidyā*, the science of discussion.

Charaka, in III. 8, says that a medical man should hold discussions (*sambhāṣā*) with other medical men. Discussion increases zeal for knowledge (*saṃharṣa*), clarifies knowledge, increases the power of speech and of achieving fame, removes doubts in the learning acquired before, and strengthens convictions. In the course of these discussions many new things may be learnt and often, out of zeal, an opponent will disclose the most cherished teachings of his masters. These discussions are of two classes, friendly (*sandhāya-sambhāṣā*) and hostile (*vigraha sambhāṣā*). A friendly discussion is held among wise

and learned persons who frankly and sincerely discuss questions and give their views without any fear of being defeated or of the fallacies of their arguments being exposed. For in such discussions even though fallacies may be voiced, no one would try to take advantage of the other, no one is jubilant over the other's defeat and no attempt is made to misinterpret or misstate the other's views.

The fact that physicians in counsel earnestly discussed together, in order to arrive at right conclusions regarding both the theoretical causes of diseases and their cures is abundantly clear from even a superficial study of the Charaka Samhita, as also is their actual practical discernment in individual cases. The entire work seems a collection of discussions of learned physicians with Atri as chairman. Where differences of opinion are great, they are all noted, and Atri's own opinion on them is given, while where there was more or less unanimity, or where Atri himself lectured on specific problems, his opinion is alone given. There are also instructions how a good and clever physician is to defeat his opponents in dispute, not only in a legitimate and scientific way, but also by sophistic wrangling and unfair logical tricks. It was a practical necessity for these physicians to earn their bread in the face of strong competition, and it is easy to see how the logical tricks of *chela*, *jāti* and *nigrahassthāna* developed into a regular art of debate, not always for the discovery of truth, but sometimes for gaining a victory over opponents. We hear of debates, discussions or logical disputes in literature much earlier than the Charaka Samhita; but nowhere was the acquirement of this art deemed so much a practical necessity for earning a living as among medical men. It is therefore reasonable to suppose that the art of debate and its other accessories developed from early times in the traditional medical schools; hence they are found collected in Charaka's work.

SOURCES OF ANCIENT INDIAN MEDICINE

The historian of ancient Indian medicine is greatly handicapped by want of inscriptions or manuscripts or other records as are available for other ancient medical systems, such as those of Mesopotamia and Egypt. He has no cuneiform records or papyri to enlighten him in his work. The seals and tablets discovered at Harappā and Mohenjo-dāro are yet to be deciphered and so remain a sealed book. After the extinction of the Harappā civilisation (B.C. 1500), there are no inscriptions or

manuscripts known in India until the middle of the 3rd century B.C. To this date belong the famous inscriptions cut, at the command of Asoka, on surfaces of natural rocks or on pillars to propagate Buddhism. These are in the Brahmi script, which appears to be of Semitic origin. Thereafter one has a more or less regular series of epigraphic monuments.

The earliest available document of Indian medicine is the Atharva-veda, which forms the fourth Veda and is also known as the Brahma-veda. It was current in nine different collections. Of these only the Paippalāda and Saunakīya recensions are available; the Paippalāda recension exists only in a single unpublished Tübingen manuscript first discovered by Roth. The Saunakīya recension is what is now available in print. The Saunakīya school has the Gopatha-brāhmaṇa as its brāhmaṇa and five sūtra works, viz. Kausika, Vaitāna, Nakṣatra-kalpa, Āṅgīrasa-kalpa and Sānti-kalpa; these are known as the five kalpas. Of these the Kausika-sūtra is probably the earliest and most important, since all the others depend upon it.

The Ātreya school of medicine, to which Charaka belonged, was most intimately connected with the Atharva-veda. Indeed, Charaka asserts that a physician must be attached to the Atharva-veda. With regard to the description of bones there are some very important points in which his school was intimately connected with the Atharva-veda. Dr. Hoernle remarks: "a really important circumstance is that the Atharvic system shares with the Charakiyan one of the most striking points in which the latter differs from the system of Susruta, viz. the assumption of a central facial bone in the structure of the skull. It may be added that the atharvic term, *pratiṣṭhā*, for the base of the long bones obviously agrees with the Charakiyan term, *adhiṣṭhāna*, and widely differs from the Susrutiyan *kūrcha*."³⁶

We have no medical records for the period between the close of the vedic collections and the rise of schools of medicine. Later medical literature refers to two kinds of treatises as having existed during this period: the tantras and the kalpas. Tantras deal with separate branches or special subjects and kalpas are monographs on special subjects. Thus we have Agadatantra, Rasāyanatantra and Vājīkaranatantra mentioned in connection with the 'mythical' Āyurveda. The Uttara-tantra mentions a number of tantras or treatises which the writer of that treatise consulted for the preparation of his own work. He mentions a *sālākya-tantra* of Nemi, Kaumara-tantras by Jivaka and Kasyapa, and the tantras on *Kāya-chikitsa* by the six pupils of Ātreya. We read of Susruta's *Salya-tantra* or treatise on major surgery.

Finally we have the Uttara-tantra by the younger Susruta. Of the early Kalpa works, which were mostly monographs on pharmacological or pharmacopoeic subjects, we have several examples in the Navanītaka. We have a Yavagu-kalpa on the preparation of gruels, Haritaka-kalpa on Chebulic Myrobalam, Silajatu-kalpa on bitumen, a Chitraka-kalpa on the plumbago plant, the Lasana-kalpa on garlic.

Following the tantra-kalpa period we have the period of samhitas. We have three samhitas available : viz. the Bhela Samhita, the Charaka Samhita and the Susruta Samhita. These three groups form our main sources for classical medicine. Consideration of them must be taken separately.

There is only one copy of the Bhela Samhita now extant. "The Bhela Samhita, which for a long while was believed lost, has been retrieved in a neglected South Indian manuscript. Though it is in a regrettably poor state and abounding in corrupt readings, it bears witness to the same early tradition as does the well preserved Charaka Samhita. Both reflect the teaching of the Ātreya school from which they stem. The Bhela Samhita makes use of the same subdivision of medical learning under eight major headings which forms the structure of Charaka's compilation. It is an important source of Ancient Indian Medicine as it is valuable in checking the contents of Charaka Samhita." ³⁷ This has now been published by the Calcutta University, in Sanskrit.

Charaka, Susruta and Vāgbhaṭa form the famous "Triad of the Ancients" (*vyddha-trayi*). We have noticed that according to the medical tradition Ātreya had six pupils, viz. Agnivesa, Jatukarna, Parāsara, Bhela, Hārīta and Kṣīrapāni, all of whom wrote treatises on medicine called tantras. These tantras were in existence in the time of the author of Navanītaka, in the late 2nd or early 3rd century A.D. Now we have only the Agnivesa tantra and the Bhela Samhita. The former has had a changeful history. In its original form it has not survived, though it appears to have existed in the 11th century A.D., as the commentator Chakrapānidatta quotes from it. At present it exists only in a redaction undertaken, at a much later date, by a Kashmiri physician named Charaka. He, however, appears not to have completed the redaction, since the concluding portions of it, about one-third of the whole work, were supplied several centuries later by another Kashmiri physician named Dṛdhabala. Thus what is now known as the Charaka Samhita is not the work of one author but of three, viz. Agnivesa, Charaka and Dṛdhabala. It is important to remember that the Agnivesa-tantra, its redaction by Charaka and the complete work known as

Charaka Samhita are separate works and belong to different centuries. The present Charaka Samhita, therefore, is full of limitations and difficulties as a source book. The trouble is that we do not know what are the original contributions of the three authors. There is evidence that the redactors not only edited the original text of Agnivesa but also added their own views and other extraneous matter. Agnivesa lived about the 6th century B.C. Charaka's date is a matter of keen controversy. He is believed to have been court physician of Kanishka, but there is controversy about the latter's date. There are three theories about it, one connecting him with the so called Vikrama era in 58 B.C., another with the Saka reign in 78 A.D., and the third placing him about 123 A.D. The weight of opinion favours the last date. Dṛdhabala, according to Hoernle, belongs to about the 9th century A.D. Thus chronologically there is a wide gap between the three authors. The portions contributed by Dṛdhabala according to his own statement (C.S. VI. 28. 273-5) are two entire *sthānas*, the 7th and the 8th and 17 out of the 28 (30 according to another mode of reckoning) chapters of the 6th *sthāna*. The puzzle is to know exactly which of the 17 chapters were contributed by Dṛdhabala. Great help can be derived in this from the Bower manuscript. The obvious assumption is that Dṛdhabala added the last 17 chapters of the 6th *sthāna*, and the 7th and 8th *sthānas*. But the trouble is that tradition presents us with two serial orders, both found in the existing manuscripts, one of Jivānanda and the other of Gangādhara. These manuscripts agree with regard to the first six chapters. The next three chapters, as indicated by the formulae in Navanītika, are Arsas, Atisāra, and Visarpa. There are no quotations from Madātyaya and Dvivranīya. Hoernle, on these considerations, comes to the conclusion, on the testimony of Navanītika, that the traditional order which gives Arsas, Atisāra, Visarpa, Madātyaya and Dvivranīya as the five chapters following the initial six chapters, about which there is not any doubt as to authorship. The traditional order which Navanītika confirms is that adopted by Jivānanda. The entire samhita as revised by Dṛdhabala is sometimes referred to as the Kashmiri recension (Kashmira-patha). This recension came into existence only after the time of Madhava (7th or 8th century A.D.) as Madhava quotes only from the portions attributed to Charaka and not from the portion contributed by Dṛdhabala.³⁸

"Charaka Samhita is the store house for the rich harvest gathered from the preceding creative centuries, in the form of monographs, treatises and lessons. In content these are inde-

pendent to a large extent and tend to repetition, increasing the bulk of the available information and offering, in incomparable detail, a valuable source of insight into the speculative implications of medical thought.”³⁹

The next important source of Ancient Indian Medicine is Susruta Samhita. This is our main, if not the only, source as far as surgery is concerned. Like Charaka Samhita, Susruta Samhita is also not the original work of Susruta. The original work of Susruta the elder, before it was revised and supplemented by the anonymous Susruta the younger, is his Salya-tantra. In fact, the very name Uttara-tantra or ‘later tantra’, which Susruta the younger has given to his complementary part of the compendium, implies that the original portion, which he revised and complemented, was the early tantra of Susruta the elder, and by that name, viz., Susruta Salya-tantra, Susruta the elder’s work is still referred to in the commentary of Gayadaśa. Susruta’s original work consisted of only five sections and deals mainly with surgical matters. At a later period, an anonymous writer composed a supplement called the Uttara-tantra which treated all subjects unnoticed by Susruta the elder. This anonymous writer, according to Dallana is believed to be Nāgārjuna. Some identify him with the well known Buddhist patriarch of that name who is said to have been a contemporary of King Kanishka. If this surmise is correct, then both the Agnivesa Samhita and Susruta’s Salya-tantra were revised about the same time, i.e. during King Kanishka’s reign, about second century A.D. What is known as the Susruta Samhita is really the Salya-tantra of Susruta with the supplementary Uttara-tantra. While Susruta Samhita was complete by the 2nd century A.D., Charaka Samhita was yet to receive Dṛdhabala’s redaction. The Uttara-tantra is of great importance in the study of ancient Indian medicine. It gives an insight into the state of medicine at the beginning of the Christian era. In his introduction, the author of Uttara-tantra says: “This part comprises within it the specific descriptions of a large and varied list of diseases, viz., those which form the subject matter of the Sālākya-tantra (diseases of the eye, ear, nose and throat) as narrated by the king of Videha; the aetiology and symptomatology, etc., of diseases peculiar to infants and women (Kaumāra-bhṛtya), the pathology, etc., of those diseases mentioned in the six books of the Practice of Medicine *par excellence* (Kāya-chikitsa) compiled by the holy sages of old and the diseases known as Upasarga (e.g. Bhūtopasarga: Demonology) as well as diseases of traumatic origin are also included in this supplementary text.” The six books on the practice of

medicine compiled by sages of old, as Dallana points out, must refer to the treatises of the six pupils of Ātreya. This is the first reference we have to the existence of these treatises. We learn also of the growth of surgery as an independent discipline. It mentions the Sālākya-tantra of Videha, traditionally the founder of the science of Ophthalmology. Bhūtavidya and Kaumāra-bhṛtya do not form a part of either Charaka Samhita or of Susruta Samhita proper. They are introduced by the back door into classical medicine, showing that Bhūtavidya still commanded a great deal of attention. The existence of a Tantra-kalpa period in Indian medicine prior to the samhita period is confirmed by Uttara-tantra. It would be interesting to know where the author of Uttara-tantra got his materials for his Bhūtavidya and Kaumāra-bhṛtya. They formed part of the 'mythical' Āyurveda, but not of the samhitas of Charaka or Susruta. It must have been from a school prior to Agnivesa and Dhanvantari to which perhaps the Āyurveda belongs.

Regarding the date of Susruta, we have the following indications: He must have been acquainted with the doctrines of Ātreya. With reference to the bones of the human body, he introduces his own exposition with a remark pointing to the difference between Ātreya's system and his own in respect of the total number of the bones. This proves that Susruta cannot be anterior to Ātreya. On the other hand, there are indications that the author of the Satapatha Brāhmaṇa, a secondary Vedic work, was acquainted with the doctrine of Susruta. The exact date of that work is not known, but it is with good reason referred to the 6th century B.C. The probability, therefore, appears to be that Susruta was a rather younger contemporary of Ātreya, or, let us say, a contemporary of Ātreya's pupil Agnivesa. There exists an Indian medical tradition which assigns the revised and supplemented edition of Susruta's original work to Nāgārjuna. If he should be the well-known Buddhist patriarch of that name, who is said to have been a contemporary of King Kanishka, his date would practically coincide with that of Charaka. Accordingly the original Compendia of Agnivesa and Susruta should have been revised and re-edited at much the same time.

One of the most important documents in connection with ancient Indian medicine is the Bower Manuscript.⁴⁰ It was found in Kuchar, in Eastern Turkistan, in February 1890 and is named after Bower, to whom it was sold. Hoernle has critically edited this document and we owe our knowledge of it to him. According to him the document consists of not less than

five distinct parts. The first part consists of 31 leaves and contains the medical work. The second portion, which immediately follows the first, consists of five leaves and forms a sort of collection of proverbs and sayings. The third consists of four leaves and contains the story of how a charm against snake bite was given by Buddha to Ananda while he was staying in Jitavana, the garden of Ananthapura. The fourth consists of six leaves. It is preserved in rather an unsatisfactory condition and appears to contain a collection of proverbial sayings similar to the second portion. The fifth portion consists of five leaves and contains another medical treatise. It appears to be the commencement of a larger work.

The first portion, consisting of 31 leaves, is the most important and is divided into three parts. The first of these contains a monograph or kalpa on Lasuna or Rasuna (*Alium setivum*) commonly known as garlic. The second part, called the 'Navanītaka', consists of 16 chapters, containing mostly formulae. They are : (1) formulae for powders, (2) formulae for various kinds of clarified-butters, (3) formulae for medicated oils, (4) miscellaneous formulae, (5) formulae for enemas, (6) formulae for tonics, (7) formulae for gruels, (8) formulae for aphrodisiacs, (9) formulae for collyriums, (10) formulae for hair-washes, (11) the modes of using chebulic myrobalan, (12) the modes of using bitumen, (13) the modes of using the plumbago root, (14) the treatment of children, (15) the treatment of barren women, (16) the treatment of women who have no children.

THE DATE OF THE BOWER MANUSCRIPT : None of the several parts are dated. The existing version was not copied from the author's manuscript but from some intermediate copy of it. On palaeographic evidence Hoernle assigns the date to between 350 and 375 A.D. for the present manuscript. This supplies us with the lower limit for the date of the copy. In view of the necessary interval between the original and the existing monograph the date of the original may be placed provisionally about the beginning of the fourth century A.D., that is about 300 A.D. Not all the parts are of the same date. From our point of view the date of Navanītaka is most important.

ON THE SOURCES AND DATE OF THE NAVANITAKA : The name and identity of the author of Navanītaka are not known. The final colophon, which perhaps would have supplied that information, together with the last chapter of the work, is unfortunately missing in the manuscript. But from the sources which the author utilised in making his compilation it is possible to estimate approximately the time when his work was written. The lower

limit for the date of the Navanītaka may be placed, like that of the manuscript, at 300 A.D. The upper limit is determined for us by the circumstance that the Charaka Samhita and the Susruta Samhita are the two sources from which the author of Navanītaka quotes copious extracts. In the opening verse the author advises his readers that in his treatise he is going to bring together the best known formulae of the maharishis or medical authorities of his time. Then he gives two sets of formulae, one of which he quotes without naming the authors while of the other set he does name the authors. From the distinction thus made, it may be reasonably concluded that the formulae for which he names the authorities were quoted from the floating medical tradition, while formulae for which no author is quoted were from standard works of well-known authorities. By far the largest number of formulae brought together in the Navanītaka belongs to the latter class. Both the Charaka Samhita and the Bhela Samhita must have been well-known standard books at the time of the author of the Navanītaka, for he makes copious extracts from them without naming them as his sources. From Bhela Samhita fifteen formulae are taken and from Charaka Samhita twenty-nine. Besides these forty-four formulae the Navanītaka contains a considerable number of other formulae, the authors of which are not indicated and the source of which it is at present impossible to identify. These include six formulae which occur also in the Āyurveda Sastra of Susruta, also known as Susruta Samhita. These formulae (the Amatisāra formulae) are quoted, not directly from the work of Susruta, but intermediately through the Bhela Samhita, the text of these in the Navanītaka is identical with that in the Bhela Samhita. The Navanītaka quotes the three formulae from the Bhela Samhita and the latter derives them from Uttara-tantra, which is by Susruta the younger. The three other formulae are from Susruta Samhita ; i.e., the portion written by Susruta the elder. The remaining unnamed formulae are probably taken from the treatises of the other four pupils of Ātreya, which we know were in existence at the time of the Uttara-tantra, and so may be presumed to have existed when the Navanītaka was compiled. Since these formulae are quoted without naming the authors, it may be presumed that these three samhitas, i.e., the Charaka Samhita, the Susruta Samhita and the Bhela Samhita, were all in existence some time before the compilation of Navanītaka. There are no formulae from that portion of Charaka Samhita which is attributed to Dṛdhabala. We know nothing definite about the date of Uttara-tantra or the Bhela Samhita. But, as already mentioned, we can form a fair guess

as to the date of composition of Charaka Samhita, viz., the early part of 2nd century A.D. — about 125 A.D. Taking this date as the upper limit and 300 A.D., the probable date of the Bower manuscript as the lower limit, and allowing the necessary interval for the growth of the samhitas into standard authorities, the late 2nd century A.D. may be taken provisionally as the time of compilation of the Navanītaka.⁴¹

The importance of the Navanītaka as a source book for ancient Indian medicine cannot be overestimated. In the first place, it confirms the existence of the medical classics, that is, the six treatises of the pupils of Ātreya, the Charaka Samhita, that portion which is attributed to Charaka, the Susruta Samhita, the Uttara-tantra, and the Bhela Samhita before its own compilation at the end of 2nd century A.D. In the second place, it gives us an idea of the growth of Indian medical literature. The samhitas do not represent the earliest stage of Indian medical literature but show that it was preceded by a still earlier stage, in which the separate branches or special subjects of medicine were dealt with in separate tantras or treatises and special kalpas or monographs. Subsequently the contents of these tantras and kalpas were, in a compressed and selective form, compiled in samhitas or compendia. Navanītaka itself is a compilation from these tantras and kalpas. In the third place, it offers invaluable help in fixing the dates of the various medical classics. From a critical study of the formulae quoted by it, we are able to arrive at the conclusion that the six tantras of the pupils of Ātreya are the oldest, next come the Charaka Samhita, that portion attributed to Charaka, the Salya-tantra of Susruta, the Uttara-tantra of Susruta the younger, and finally the Bhela Samhita. There is no confirmation that there ever existed any samhitas based on the tantras of the other four pupils of Ātreya, viz., Hārīta, Jātukarna, Parāsara and Kṣīrapāni. Lastly it helps us to settle the vexed question of the chapters contributed by Dṛdhabala and their order in the Chikitsa sthāna. It settles also the probable date of Susruta.

The next member of the ancient triad is Vāgbhaṭa. It is well known that there were two Vāgbhaṭas, Vāgbhaṭa I and Vāgbhaṭa II.* Vāgbhaṭa I wrote a compendium on General Medicine, which, on the model of the supplemented compendium of Susruta, he divided into six sections (*sthānas*) and to which he gave the name of "the summary of the Octopartite Science" (*Aṣṭāṅga Samgraha*). His object was to gather up into a harmonious

* There is also a view that it was the same Vāgbhaṭa that wrote the two books "Aṣṭāṅga Samgraha" and "Aṣṭāṅga Hṛdaya".

whole the more or less conflicting medical systems current in his time, especially those contained in the compendia of Charaka and Susruta. The *Aṣṭāṅga Samgraha* is frequently quoted in commentaries. *Vāgbhaṭa II* clearly refers to it as his chief source. It is composed of a mixture of prose and verse and reminds us of Charaka and Susruta. Its connection with Charaka, and especially with Susruta, is closer than that of the *Aṣṭāṅga Hṛdaya* of *Vāgbhaṭa II*. *Aṣṭāṅga Samgraha* contains much independent material and is, therefore, of the greatest value for verifying as well as supplementing Charaka and Susruta. It is conjectured by Hoernle and others that the statement of I-tsing (A.D. 675-685), that the light parts formerly existed in eight books, and that a man had lately epitomized them and made them into one bundle, and that all physicians in the five parts of India practised according to that book, alludes to the *Aṣṭāṅga Samgraha* of *Vāgbhaṭa the elder*. In that case *Vāgbhaṭa I* must have flourished either late in the 6th century or early in the 7th, for I-tsing speaks of him as having epitomised the work lately; on the other hand time must be allowed for the circulation of such a work in the five parts of India.⁴²

Mādhavāchārya achieved an outstanding reputation, dealing exclusively and exhaustively with the diagnosis of diseases. His work is named *Rugvinischaya* and is a compendium of pathology or *nidāna* and is simply called *Nidāna*. It is one of the most popular works on Indian medicine. A popular stanza assigns to him a rank equal to that of the "Triad of the Ancients". *Mādhava* is considered the foremost authority on diagnosis (*nidāna*); while *Vāgbhaṭa* is unrivalled in the principles of medicine (*sūtra*), *Susruta* and *Charaka* are given first rank in the knowledge of surgery and anatomy (*sarira*), and of therapeutics (*chikitsaka*), respectively. Both *Charaka* and *Susruta* devoted sections of their *samhitas* called *Nidāna sthāna* to the discussion of pathology and diagnosis and they also deal with diagnosis of diseases in the sections on therapeutics, but *Mādhava's* deals exclusively with *Nidāna*; hence its importance. The order in which this work treats the important diseases in 70 *nidānas* along with their causes, symptoms and complications has been a standard to all subsequent writers. *Mādhava nidāna* is often literally identical with *Charaka* and *Susruta* and in this case the borrowing has to be taken for granted; but his system, enumeration and description of diseases mark an advance on *Charaka* and *Susruta*. Thus he devotes a separate chapter, the 54th *nidāna*, to smallpox (*masurika*) whereas *Susruta* mentions it only among minor diseases. *Mādhava* is anterior both to

Dr̥dhabala and Vāgbhaṭa II, as he does not quote from the Kashmiri recension of Dr̥dhabala, but only from those portions of the Charaka Samhita attributed to Charaka. Arunadatta, in his commentary on Vāgbhaṭa's compendium, expressly refers to Dr̥dhabala's edition of the compendium of Charaka as the source of one of the verses of Vāgbhaṭa II. If Mādhava may be identified with Badan, 'Yedan' (i.e., Nidān), a work on pathology translated very early into Arabic, then Mādhava may be placed in the 8th century A.D.

Vāgbhaṭa II is best known as the author of Aṣṭāṅga Hṛdaya-Samhita, i.e., the quintessence of medicine. With arrangement similar to Susruta, in six sthānas and 120 chapters, it contains a lucid and versified presentation of the whole of medicine, with special reference to surgery, as in Susruta. He quotes both from Charaka and Susruta and also Bhela, Nimi, Kasyapa, Dhanvantari, and, in the introduction, the son of Atri, Agnivesa and other rishis. Aṣṭāṅga Hṛdaya conforms more closely with Charaka than with Susruta. At the end of it he also mentions the Aṣṭāṅga Samgraha of Vāgbhaṭa the elder, which the author clearly characterises as his chief source. The evidence of the Tibetan and other sources points to the eighth or ninth century as the probable date of Vāgbhaṭa II. If Aṣṭāṅga Hṛdaya can be identified with the book 'Atanka' of the Arabian sources it would point to the 8th century as the probable date.

The three authors Mādhava, Dr̥dhabala and Vāgbhaṭa II were posterior to Vāgbhaṭa I, and anterior to Chakrapānidatta. The evidence of Arabic sources points to the 7th or 8th century for Mādhava and that of Tibetan and other sources to the 8th or 9th century for Vāgbhaṭa II. Dr̥dhabala takes his place immediately between Mādhava and Vāgbhaṭa II. Accordingly it is possible that all three of these medical writers come in the period from the 7th to the 9th century, at no great interval from one another. In any case, none of them can be later than 1060 A.D., the date of Chakrapānidatta.

Another important source of ancient Indian medicine is the Mahavagga of the Vinaya-pitaka.⁴³ In Kandhaka VI "On Medicaments" we have a reference to diseases produced by *Pitta* and *Vayu*. Besides, it is mentioned that a certain Bhikkhu had a superfluity of humours in his body. Jīvaka is said to have treated the Blessed for a disturbance of the humours. In both these cases the word *doṣa* is used. Among the medicaments it mentions roots, leaves, fruits, gums, five kinds of salt, chunam, as well as raw flesh and blood. Among medical appliances it mentions the pestle and mortar, ointment sticks, a nose spoon and

a pipe to inhale fumes through the nose. It speaks of fomentations (*swedana*), blood letting for ague, a horn to let blood, lancets to open boils and bandages. It mentions the same treatment for the derangement of *doṣas* as in Charaka and Susruta. In Kandhaka VIII, it gives an account of the birth, childhood and medical training of Jivaka. It mentions that he had his training under a famous physician of the times at Taxila. It also states that he was the court physician of King Bhimbisara.

COMMENTATORS AND THEIR DATES

Among the commentators the name of Chakrapānidatta occupies a prominent place. He lived about 1066 A.D., and wrote a complete and authoritative commentary on the Charaka Samhita, called the Charaka Tātparya Tika or Āyurveda dīpika. He also wrote a commentary on Susruta Samhita called Bhanumati; but only a small portion of it has survived, namely that on the sūtra-sthāna. There is evidence to prove that Chakrapāni's commentary extended to the whole of the samhita. Both these commentaries are of great importance for the study of Charaka Samhita and Susruta Samhita. He quotes in them passages from various authors, particularly from the Tantrās of the pupils of Ātreya, which were available in his time but are no longer extant. According to Hoernle, the commentary, Bhanumati, is of great help in restoring the original readings in the present manuscripts of Susruta.⁴⁴ Of the commentaries on Susruta Samhita the most important one now current is that of Dallana called the Nibandha Samgraha. Dallana has been placed by Hoernle in the 12th century A.D. On the compilation of Vāgbhaṭa II we have a commentary by Arunadatta called Sarvāṅga-sundari. Arunadatta probably lived about 1220 A.D.

The creative period of ancient Indian medicine ends with the samhitas of Charaka and Susruta. Charaka accomplished the final synthesis of Indian medicine, and Susruta that of Surgery. Their works have thereafter held undisputed sway in Indian medicine up to the present time. The Indian medical writers after Charaka and Susruta were only their imitators and abstractors. No real original work was accomplished after them.

THE RELATION BETWEEN GREEK MEDICINE AND INDIAN MEDICINE

"The medicine of Egypt and the East, extensive and intricate as it was, in so far as it was not Greek, did not contain even the rudiments of science. To it the Western medicine owes virtually

nothing." remarks Allbutt.⁴⁵ In so far as it was not Greek suggests that any scientific elements found in medicine of the East is borrowed from the Greeks. "Scientific medicine began with the Greeks" is an obsession of Western historians of medicine.⁴⁶ The West owes everything to the Greeks. "Without what we call our debt to Greece we should have neither our religion nor our philosophy nor our science nor literature nor our education nor politics. We should be mere barbarians," writes Dean Inge.⁴⁷ Hellenism is everything to Western civilization, but whether it had any influence on Eastern civilizations, is very doubtful, and remains to be proved. The possibility, at least, of a dependence of either on the other cannot well be denied, when we know as an historical fact, that two Greek physicians, Ktesias, about 400 B.C., and Megasthenes, about 300 B.C., visited, or resided in Northern India. A study of the *samhitas* of Charaka and Susruta reveal many analogies between the Indian and Greek systems of medicine. Jolly gives a list of some of these analogies :— The accomplished humoral pathology ; the raw, ripening and the ripe stages of fever (C.S. VI. 3. 128) ; the division of healing remedies into hot and cold, also dry and oily i.e., moist (C.S. I. 26.80) ; the healing of diseases by remedies of opposite character (C.S. I. 7.42) ; the purely Hippocratic emphasis on prognosis (C.S. V. 1) ; the characterization of the physicians and the directions given to them reminding us of the oath of Asclepias (C.S. III. 68) ; the influence of seasons in dietetics (C.S. I. 6) ; the quotidian, tertian and quartan fever (C.S. VI. 3.32) ; *Kṣaya*, *phthisis* etc., in individual diseases ; the often occurring sensation of creeping of ants on the body in respect of symptoms ; the simultaneous formation of all parts of the body in the doctrine of development (S.S. III. 3.18) ; the birth of twins by the equal division of quantity of semen (C.S. IV. 2.11) ; the relation of the right part of the body to the male sex of the foetus (S.S. III. 3.20) ; the viability of the foetus in the seventh month and the contrary in the eighth month (S.S. III. 3.18) ; the dismembering of the dead foetus and its extraction with a hook fixed in the eye sockets (S.S. IV. 15.7) ; the movements for the advancement of placenta (C.S. IV. 8.82) ; in surgery, the method of lithotomy (S.S. IV. 7.13) ; the paracentesis in dropsy (S.S. IV. 16-22) ; branding, cauterising, cutting of haemorrhoidal tumours (S.S. IV. 6.2) ; bleeding, cauteries and many surgical instruments ; the operation of the right eye with the left hand and of the left eye with the right hand and other details of the operation of the cataract in ophthalmology (S.S. VI. 17.35).⁴⁸ With this apparent similarity that exists between Indian and

Greek medicine, Western scholars have expressed a doubt as to the originality of Indian medicine and allege that Indian medicine has borrowed these elements from the Greek.

There are only two periods in Indian history when borrowing, if any, could have occurred. The direct impact of Hellenism on India occurred during the conquest of Alexander and the centuries following this conquest, i.e., the period covering the Mauryan and Kushan dynasties, i.e., 323 B.C. to 300 A.D., or the Gupta period (300-650 A.D.), when there is definite evidence of borrowing from the Greeks in the field of astronomy. But the Gupta period may be left out of the discussion as it extends far beyond the period of Susruta and Charaka, the creative period of Indian medicine, i.e., the 6th century B.C. to the 2nd century A.D. So, the borrowing must have taken place during the Mauryan and Kushan periods, i.e., 323 B.C. to 300 A.D. Sylvain Levi actually suggests that the Greek influence, thought to be found in Charaka's teaching, is easily explained, if he lived at the time and at the court of Indo-Scythians, when Hellenism seemed to be conquering the old Brahmanic civilization, as Charaka, according to the Tibetan sources quoted by him, was the trusted physician of Kanishka.⁴⁹ Vincent Smith, discussing this same problem, denies any such Hellenistic influence on the Mauryan civilization. He remarks, "The question as to the extent of Greek, or more accurately, Hellenistic influence on Indian civilization is of interest and always has been warmly debated by European scholars, who naturally desire to find links connecting the unfamiliar doings of isolated India with the familiar Greek ideas and institutions to which Europe owes so much. Alexander's fierce campaign produced no direct effect upon either the ideas or the institutions of India. When Chandragupta Maurya swept the Macedonian garrisons out of the Punjab, that was the end of Hellenism on the Indian soil for the time. It may be said that Greek or Hellenistic influence upon India during this period was slight and superficial. The early medical knowledge, as expounded by Charaka, Kanishka's physician, has been supposed to betray acquaintance with the works of Hippocrates but the proof does not seem to be convincing."⁵⁰ Jones has affirmed it as improbable "that the Brahmin should have borrowed from other nations, especially from the Greeks whom they despised in particular. The only instance where borrowing from the Greeks is established is in the science of astronomy, but the Hindu writers themselves acknowledge the source from which they derived their knowledge. But no such reference to foreign sources occurs in Hindu medical classics and they do not

contain a single technical term which points to foreign origin.”⁵¹ Weber remarks with regard to the probability that the system of medicine expounded in Susruta was borrowed largely from the Greeks, “on the contrary, there is much that seems to tell against the idea of such Greek influence. In the first place, the Yavanas are never referred to as authorities, and amongst the individuals enumerated in the introduction as contemporaries of Susruta, there is not one whose name has a foreign sound. Again the cultivation of medicine is by Susruta himself, as well as by other writers, expressly assigned to the city of Kāsi in the period of Dhanvantari. And lastly the weights and measures to be used by the physicians are expressly enjoined to be either those employed in Maghada or those current in Kalinga; whence we may fairly presume that it was in the Eastern provinces, which never came into close contact with the Greeks, that medicine had its special cultivation.”⁵²

With regard to the question what material was borrowed, it is not alleged that anatomy was borrowed from the Greeks. If ancient Indian medicine borrowed anatomy from the Greeks, it must have been before the Alexandrian School of Herophilus and Erasistratus in the early part of the 4th century B.C., as the knowledge of this school appears in some particulars, such as the nervous and the vascular systems, to be much in advance of the early Indians. If any borrowing occurred it must have taken place during the time of Hippocrates, but the anatomy of the Indians is much in advance of the school of Hippocrates (5th century B.C.). It is alleged that the Indians borrowed their medical theories and surgery from the Greeks on account of the similarities between them. The most important and fundamental borrowing it is alleged is the “humoral theory” which forms the basis of both systems.

But too much has been made of the alleged similarities while no attention has been paid to the essential differences between these two theories. In order to establish a dependence of the Indian “humoral” theory on the Greek, one would require evidence of agreement in points which are both peculiar and essential in both. The Greek theory starts with the four elements: earth, air, fire and water. The humours were also four: blood, phlegm, yellow bile and black bile. “According to Hippocrates and the classical theory of Greek medicine, health existed when these humours were present in the body in proper proportion to each other; i.e., when there was an eucrasia or a proper mixture or crasis of the body fluids. When one or other happened to be in excess, a dyscrasia or abnormal mixture

resulted. But there was a natural tendency in the organism to heal itself ; no sooner did it find the environment acting prejudicially upon it, than it in turn reacted. Finding the humours in a state of dyscrasia, it proceeded to bring them back to the proper proportions. This process of cure was called *pepsis*, usually translated *coction* ; this was a kind of cooking or ripening of crude matter ; it was carried out by means of the 'innate heat' and resulted in a restoration of *eucrasia* and an elimination of the excess matter, or waste products. In acute diseases this elimination or crisis of the offending humours tended to take place on certain definite days of the disease (critical days), being effected by sweating, purging, urination or even haemorrhage. A third possible way of cure was by *apostasis*, a kind of migration of the disease and its settlement or deposition in other parts." ⁵³

The Indian theory starts with the *panchabhūtas* or five elements : earth, air, fire, water and ether. The humours (*doṣas*) are three : air (*vāyu*), bile (*pitta*) and phlegm (*kapha*). Besides these *doṣas* (humours) the theory names seven *dhātus* or constituents of the body (the tissues). The humours (*doṣas*) do not increase or decrease spontaneously. Certain causes or *nidānas* for their derangement are recognised. Health is defined as *dhātu-samya* or equilibrium of the *dhātus*, among which the humours (*doṣas*) were counted when they were in their normal measure. Disease is defined as *dhātu-vaishamya* or the upset of the equilibrium of the *dhātus*. For the production of a disease, three things were needed ; the *nidānas* or upsetting causes, *doṣas* or vitiators and *dhātus*, the constituents vitiated. When the *doṣas* are disturbed, they in their turn act on the *dhātus* or constituents (tissues) of the body and produce disease in them. The vitiated humours (*doṣas*) are brought back to their normal state, not naturally, but by diet, medicines and regimen of life.

The Greek humours form a tetrad whereas the Indian form a triad. Blood is an important humour in the Greek theory and is not one in the Indian. Air does not form one of the Greek humours, while it is the most important in the Indian theory. There is also a fundamental difference in the conception of the production of diseases. In the Greek theory it is the humours that produce disease by their mingling ; in Indian medical terminology this would be termed a *doṣa-vaishamya* (imbalance of the *doṣas*). In the Indian theory the *doṣas* act on the *dhātus* (constituents) of the body and produce disease in them ; i.e., disease is considered to be a *dhātu-vaishamya* (imbalance of the *dhātus*). So it will be seen that while the similarities are superficial, the differences are fundamental.

Besides, we have in early Buddhistic literature independent evidence of the existence of the "accomplished" humoral theory at the time of Buddha (557-477 B.C.). In the Vinaya texts we have reference to the humoral theory and the Āyurvedic method of treating these disorders (M.V. V.x). Rhys Davids and Oldenberg ascribe 370-360 B.C. as the probable date of the Vinaya Texts.⁵⁴ In the Mahabharata, whose date is a matter of a great deal of controversy and which many authorities consider not later than the 4th century B.C., we have a specific description of the *tri-dhātu* theory (M.B. XII. 343.83-85). Thus, from the chronological point of view, the Indian theory seems to have the priority.

The origin of Indian medicine is not to be sought in Greece, Egypt or any other country. The Indians are solely responsible for it. It is not as if medical history traced Indian medical ideas only to a point at which they were already highly developed and could not explain their beginnings. We can trace the history of the Indian humoral theory to its purely Indian beginnings. The name "*tri-dhātu*" can be traced to the Rīgveda (R.V. I. 34.6). In the Atharva-veda diseases are referred to, as those produced by water, those produced by air, and those produced by fire or those which are dry or burning (A.V. I. 12.3). This division foreshadows the classical *tri-dhātu* theory. The metaphysical basis of ancient Indian medicine was supplied by one of its own schools of philosophy, the Nyāya-vaiśeṣika system. It is sheer prejudice to suppose that from these data they could not make the simple effort of building a medical theory.

Another fact which is of some importance in connection with the question of the borrowing of medical ideas from the Greeks by the Indians is the question of pulse lore. If Charaka's medical ideas were influenced by the Greek ideas, as is alleged by Sylvain Levi, it is a curious fact that the Indians did not borrow the pulse lore also. This was introduced into Greek medicine by Praxagoras of Cos (340-320 B.C.). Herophilus counted the pulse by a water clock. The Pneumatists had an elaborate pulse-lore and by the time of Galen it had become an important means of diagnosis. Charaka belongs to the 2nd century A.D. and if he had borrowed anything from the medicine of the Greeks of his time, certainly one would think that the pulse-lore would have been the first. As a matter of fact, pulse-lore is not mentioned in the ancient medical classics of Charaka and Susruta. It finds its way into Indian medicine in the 13th century A.D. So also the use of opium was prevalent in Greek medicine at the time of Charaka and yet no mention is made

of it in the ancient medical classics. It also makes its appearance in the 13th century A.D.⁵⁵

It seems, therefore, unlikely that Indian medicine borrowed its medical views from the Greeks. This raises the alternative question whether the Greeks borrowed their medical ideas from the Indians. This assumption does not seem so very improbable. "Philosophical speculation, as we know it, seems to have begun on the periphery, rather than at the centre of the Greek world. At any rate, the cosmological speculators hailed from Asia Minor and from southern Italy or Sicily. The earliest speculators were certain wise men from the East, the group from Ionia in Asia Minor."⁵⁶ The philosopher who influenced Hippocratic medicine most was Pythagoras. Hippocrates derived his doctrine of the four humours from Alcmaeon, who belonged to the school of Pythagoras. The Hippocratic emphasis on diet and regimen, in preference to medicines, in the treatment of diseases may be traced to Pythagorean influence. There is no doubt that the teaching of Pythagoras implied the introduction of a new spirit which was not characteristically Hellenic. Empedocles also was influenced by the school of Pythagoras. "After a careful review of the points of contact and weighing as dispassionately as possible the historical evidence for and against the originality of Pythagoras, we are unable to come to any other conclusion than that this philosopher took his whole system indirectly from India," writes Hopkins.⁵⁷ The discovery of the Indus Valley Civilisation has shown the intimate relations that existed between this civilisation and the ancient civilisations of Sumer and the Aegean civilisation of Asia Minor. Indigenous Indian drugs are mentioned in the works of Hippocrates and earlier writers; e.g. Kardomomen, Amomon, Peperi, Kinnamonas, Akoras, Sesamon, etc., and some of them bear corrupted Sanskrit names. The use of these drugs implies some knowledge of the theory of their actions, as known to the Indians. The humoral theory of the Greeks is based on the philosophical speculations of Pythagoras and Empedocles which bear a very close resemblance to the philosophical thought prevalent in the 6th and the 5th centuries in India, whereas the *tri-dhātu* theory, its counterpart in Indian medicine, as we have seen, is a native growth of the Indian mind. The Hippocratic conception of the influence of the seasons on the fluctuations of the humours and the predominance of certain diseases in certain seasons bears too close a resemblance to the views held by Charaka and Susruta on the same subject as expressed in their description of *ṛtucharya*, to be accidental.⁵⁸ "Some coincidences would appear rather to be those

of observers of the same facts than borrowers from the same books." But others must be attributed to the influence of Indian thought on Greek medical speculations in the 6th and 5th centuries B.C.

THE PHYSICIAN, HIS TRAINING, STATUS AND PRACTICE

The profession of a physician must have been one of great antiquity in India. We have mention of "lay" physicians, in addition to priest-physicians, in the Vedas. In Rigveda IX. 112, we read : "We have various hopes and plans and many are the ways of men, the craftsman seeks for jobs to do, the priest his flock, the leech the sick. I am a poet, dad is a leech." So also in the Atharva-veda, we read of "medical" practitioners. In A.V. II. 9.3 we read that there were hundreds of "medical" practitioners and thousands of herbs, but what can be done by these can be effected by binding an amulet. Again in A.V. II. 9.5 the Atharvan who binds the amulet is described as the best of all good doctors. In Manu we read of a controversy between the priest-physicians and the caste of physicians, the vaidyas. Thus it is evident that the profession of physician was of very ancient origin and had been progressively developing over a long period before the compilation of the samhitas of Charaka and Susruta.

There were two systems of training in vogue in ancient India, the Brahmanical and the monastic. "Indian medical lore has been handed down through generations, not by faculties and bodies, colleges or research centres, but through the individual training of pupils by skilled practitioners, masters of their craft. This was the Brahmanical system and was the one in vogue in the training of the physicians at the time of samhitas."⁵⁹ We have mention of the monastic system, corresponding to our university training, in the Buddhistic works. Jivaka, the physician to Bimbisara, a contemporary of Buddha, is stated to have been educated at Taxila University under Ātreya, professor of medicine, and it is also stated that his studies lasted seven years.⁶⁰ We do not know anything of the methods or the curriculum of studies of this type of medical education.

"The science of life was to be studied by Brahmins, Kshatriyas and Vaisyas. Brahmins were to learn it for doing good to all creatures, Kshatriyas for self preservation, and Vaisyas for gain. Susruta asserts that some say a Sudra of good family and character may be admitted as a pupil. In general, all may

study this science for the acquisition of religious merit, wealth and pleasure." (C.S. I. 30.24).

The initial decision to become a physician rested with the pupil. "If an intelligent man, who knows the difficulty and lightness of all acts, the results, immediate and remote, of acts and place and time, desires, impelled by proper reasons, to become a physician, he should then, at the outset, select the particular treatise he should take up ; after this he should select a proper preceptor and present himself to him." (C.S. III. 8).

Great importance was attached to the selection of the text book (Sāstra) to be followed and studied. Charaka, discussing the various means of diagnosis, defines the three important ones (*pramānas*) as instructions of the inspired or wise (*Āptopadesa*), perception (*pratyaksha*), and inference (*anumāna*). Of these three, he places knowledge derived from the instructions of the inspired first. These instructions were to be found in the various authoritative books (Sāstras or Tantrās). Diverse treatises appertaining to the profession of a physician were in circulation. From amongst these, one should choose one "which has been honoured by men of renown and wisdom and is full of substance, which is worshipped by the inspired, which is well suited to the understandings of the three kinds of pupils, which is free from the fault of tautology, which is ascribable to a rishi, which has been well compiled in respect of aphorisms, commentaries, and abstracts in due order, which treats of nothing but the professed subject, which is free from slang and provincial words, which contains no obsolete or unfamiliar words, which is couched in words of wide import, which is duly arranged according to sense, which has been principally designed to lead to certainty of inferences, which has all the indications of a scientific treatise, and which contains proper illustrations. A treatise of this kind dispels ignorance like the bright sun dispelling darkness and discovering all things." (C.S. III. 8).

The next duty of the future physician is to select a proper preceptor, and then present himself to him. Not all persons can become teachers. Charaka lays down the following qualifications for a teacher : "He should be one whose doubts have all been cleared in respect of medical scriptures ; he should be possessed of experience ; he should be clever ; he should be compassionate towards those who approach him ; he should be pure of conduct ; he should have a practised hand ; he should have all the implements of his profession ; he should have all the organs of sense ; he should be conversant with the nature (of health, of disease, of medicaments, of time, of place, of men,

etc.) ; he should be conversant with the tendencies and the acts of the healthy and of the diseased ; he should be one whose knowledge of the medical science has been supplemented by knowledge of other branches of study ; he should be without malice ; he should be without a wrathful disposition ; he should be capable of bearing privations and pain ; he should be one well-affected towards disciples and disposed to teach them ; he should be capable of communicating his ideas to pupils that seek his instructions." (C.S. III. 8).

Not all persons are fit to be students of medicine. Acceptance or rejection of the pupil is left to the preceptor. The preceptor, who has set his mind on teaching, should first examine the person who presents himself as a pupil, to see that he possesses certain physical as well as moral and intellectual endowments. "His eyes, mouth and nasal line should be straight ; his tongue should be thin, red and unslimy ; his teeth and lips should have no deformity ; he should not have a nasal voice ; he should not be defective in respect of any limb ; he should have all his senses perfect ; he should be of a mild disposition ; he should be noble by nature ; he should not be mean in acts ; he should be disposed for solitude ; he should be free from haughtiness ; he should be of a thoughtful disposition ; he should be free from those faults which go by the name of Vyasana, viz., hunting, gambling with dice, sleeping during day time, speaking ill of others, infatuation with women, excessive addiction to singing, dancing and instrumental music, purposeless sauntering, etc. ; he should be free from wrath ; he should be endued with excellent character, purity of behaviour, devotion, cleverness and compassion for all ; he should be free from cupidity ; he should be without sloth ; he should seek the good of all creatures ; he should be prepared to obey all the commands of his preceptor. He should be possessed of intelligence ; he should be free from pride ; he should be endowed with a large understanding ; he should have power of judgment and memory ; he should have a liberal mind ; he should belong to a family the members of which have studied the medical scriptures or followed medicine as a profession ; he should have devotion for truth ; he should be fond of study ; he should be devotedly attached to both theory and practice of medicine." (C.S. III. 8). "A preceptor can admit as a pupil, a son of a Brahmin, Kshatriya or Vaisya of a good family and sixteen years of age." (S.S. I. 2).

Instruction should be inaugurated by a consecration ceremony similar to that associated with other crafts. During the initiation, the preceptor gives the following charge to the pupil : "You

should give up lust, anger, avarice, folly, vanity, pride, envy, rudeness, deception, falsehood, idleness and all other reprehensible conduct. You should always have your hair and nails cut short, should put on red coloured cloth, lead a pure life, avoid sexual intercourse and be ready to obey your superiors. You should remain, go about, lie down, sit down, eat and study according to my wishes, and you should always be ready to seek my welfare. If you fail in this your duty you will be committing sin, and your learning will be fruitless. It is the duty of all good physicians to treat gratuitously with their own medicines all Brahmins, spiritual guides, paupers, friends, ascetics, neighbours, devotees, orphans and people who come from a distance as if they are his own friends. Hunters, fowlers, outcasts, and sinners should not be treated. By acting in this way one makes himself known and attains friends, fame, wealth, and objects of desire." (S.S. I. 2). Charaka adds the following additional charges to the above : "If thou desirest to achieve success of treatment, earn wealth, acquire celebrity and win heaven hereafter, thou shouldst always seek, whether standing or sitting, the good of all living creatures ; thou shouldst, with thy whole heart, strive to bring about the cure of those that are ill ; even for the sake of thy life thou shouldst not drain those that are ill ; thou shouldst not, even in imagination, know another man's wife ; thou shouldst not, similarly, appropriate other people's possessions ; thou shouldst always clothe thyself in homely attire ; thou shouldst not keep any connections with publicans or sinful men, or with those that are abettors of sinful behaviour ; thou shouldst speak words that are soft, unstained by impurity, fraught with righteousness, incapable of giving pain to others, worthy of praise, truthful, beneficial and properly weighed and measured ; thou shouldst always conduct thyself taking note of place and time ; thou shouldst always act heedfully ; thou shouldst always strive to acquire knowledge, to cast off sloth, to keep ready with the implements and medicines thou mayest require ; while entering the family dwelling-place of the patient, thou shouldst do it with notice to the inmates and with their permission ; thou shouldst be accompanied by some male member of the family ; thou shouldst cover thy person properly ; thou shouldst keep thy face downwards ; with thy wits about thee, thou shouldst, with understanding and mind properly fixed, observe all things ; having entered, thou shouldst not devote thy words, mind, understanding and senses to anything else than what is calculated to do good to the patient or to any other object connected with the patient (than his recovery) ; thou shouldst never give out (to others)

the practices of the patient's house ; even if thou be certain of it, thou shouldst not speak of the diminution of the period of the patient's life when such speaking may shock the patient or anybody else. Even if possessed of sufficient knowledge thou shouldst not boast of that knowledge. Many people become annoyed even with an inspired person if he boasts of his wisdom. There is no end of medical science. Hence,, heedfully thou shouldst devote thyself to it. Skilfulness of practice should be acquired from others, without feeling any humiliation. Unto men possessed of intelligence, the entire world acts as a preceptor. Unto men destitute of intelligence, the world occupies the position of an enemy. Hence, observing all this, an intelligent man should listen and act up to the counsels of the one who is even a foe when these happen to be instructive and praiseworthy, capable of leading to fame and long life and prosperity and beneficial as regards his worldly condition." (C.S. III. 8).

After the selection and initiation of the pupil by the preceptor, his real training commences. The instruction, lasting six years,⁶¹ was based on a recognised and approved text book (Sāstrā) and consisted on the one hand of learning by heart rules and axioms, which were explained by the preceptor and on the other hand of practical instruction. Both medicine and surgery had to be mastered. "When the student attends at the hour of receiving instruction with purified body, dressed in his upper garment or sheet and his mind perfectly calm, the preceptor will teach him according to his capacity either one-quarter, one-half or an entire sloka at a time. The pupil should repeatedly recite this. In this way each pupil should be taught separately and the preceptor should recite the entire sloka after his pupil. Learning by rote, without understanding the meaning of what is thus committed to memory, is like the ass carrying a load of sandalwood and is labour without profit. As the ass which carries the load of sandalwood perceives the weight but not the fragrance of the sandal, so the dunces who study numerous sāstras without understanding their meaning bear their weight only. Every word, phrase and sentence ought to be heard and recited over and over again. When any subject relating to other sāstras occurs in any part of this work, it should be learned from persons well acquainted with those sāstras, for the person knowing one sāstra only cannot understand the other sāstras. The pupil who, after receiving instruction in the sāstras from the lips of his preceptor, studies it repeatedly, is the genuine physician, others are rogues." (S.S. 1. 4).

After studying the sâstras, the art of healing had to be learned practically. Even if the pupil was acquainted with all the sâstras, the preceptor, to make him properly qualified, had still to give him practical instruction in medicine and surgery. Without practical training, repeated recitation or hearing of lessons would not qualify a pupil for practice.

After his initiation the pupil shared for years the life of the preceptor, becoming a member of his household, serving him and daily watching him as he treated his patients. He assisted him in his pharmacy in preparing medicaments. He became familiar with the various tools and procedures of the medical profession.

With regard to surgical training, the preceptor was to show his pupil how to incise, divide, extirpate, etc., by performing these operations on flowers and fruits, on gourds, watermelons, cucumbers, etc. Training in puncturing, letting out fluids, etc. was to be given by performing the operations on leather bags or bladders filled with water and mud. Scarification was to be practised on stretched pieces of leather covered with hair. The operation of piercing, as in the opening of the veins, was to be shown on the veins of dead animals or on the stalk of the water-lily. Exploring by a probe was to be demonstrated on worm-eaten wood, bamboos, tubes, dried gourds, etc. Extraction was to be shown in the jack-fruit and pulp of bel fruit and the teeth of dead animals. The opening of abscesses was to be demonstrated on a lump of wax applied to a piece of wood. Sewing up was to be practised on thick cloth and on the edges of two pieces of soft leather. Bandaging was to be practised on the limbs of human figures made of wood or clay. The mode of bandaging the root of the ear was to be shown on a piece of soft flesh or the stalk of a water-lily. The application of caustics and actual cautery was to be shown on pieces of soft flesh. The withdrawal of urine from the bladder or the extraction of pus from the pelvic cavity by means of tubes was to be demonstrated on an earthen pot with a spout, filled with water, or on a gourd, etc. (S.S. 1. 9).

Susruta insists that the enormous amount of oral learning should be balanced by practical efficiency; the physician who masters both, stands firmly on both legs. Otherwise, when it comes to treating the patient, he will feel as insecure as a coward approaching the battle ground. "He who is only trained in theory but is not experienced in practice knows not what he should do when he has a patient and behaves as foolishly as a youth upon a battle field. On the other hand, a physician who

is educated practically but not in theory, will not earn the respect of better men." (S.S. 1. 9).

Along with learning and teaching, Charaka speaks of discussions with specialists in different branches. Medical men should hold discussions (*sambāsha*) with other medical men. Discussion increases their zeal for knowledge (*samharsha*), clarifies knowledge, increases eloquence, brings renown, removes doubts in the learning previously acquired and strengthens convictions. In the course of these discussions many new things may be learnt and often, out of zeal, an opponent will disclose the most cherished teachings of his teachers. (C.S. III. 8).

After having studied the *sāstras* and learnt their meaning, after having attained proficiency in reciting the *sāstras* and obtained a practical knowledge of surgical treatment, the physician should obtain the permission of the king and commence his practice; he should keep his hair and nails short and his person pure, should wear white clothes, put on shoes and have a stick and an umbrella. His appearance should be humble and his mind pure and guileless. He should be polite in his speech and friendly to all living beings and he should have an attendant of good character. (S.S. I. 10).

THE STATUS OF A PHYSICIAN

The physician has always occupied a respected place in society since ancient times. In Vedic times he wielded tremendous power and influence as priest-physician. Both as priest and physician he held a key position. He gained access even to the rulers of the country and in fact came to be recognised as the king's *alter ego* in the role of his *purohit*. He was priest, physician, sorcerer and adviser to the king, all combined. Even in the Vedas, as we have seen, there was a separate class of physicians. We may call these "lay" physicians. In the Atharva-veda we read of priest-physicians and medical practitioners. There seems to have existed a sort of rivalry between the two. The priest-physicians were more influential and the medical practitioners seem to have accepted their supremacy. But in post-vedic times, as mentioned in Manu, a controversy developed between the Brahmins knowing the Vedas and magic and the caste of physicians, or *vaidya* (known also as *bhīṣag*, *chikitsaka*, or *ambastha*). The lay physicians were gathering popularity, with the result that the profession attracted all sorts of persons. Quacks began to abound and they were particularly responsible for the bad reputation of physicians, as a result of which it was

laid down in the Dharmasāstras that one should not accept charity from a physician (*chikitsaka*). Yet the *ambasthas*, whose business was the healing art, held a high position in the hierarchy of castes, as they derived their descent on their father's side from Brahmanas.⁶² As we have seen, the teaching of the physicians, their selection and their complete training, both in theory and practice, was insisted upon and finally they were required to obtain the permission of the king to practise. Susruta speaks of two kinds of physicians. Only those were ranked as properly qualified physicians who had undergone an approved course, practical and theoretical, under a recognised preceptor. The physician who was only learned in the sāstras, but was unacquainted with the practical methods of treatment and the one who knew the technique of treatment, but from self-confidence did not study the sāstras, were both unfit to practise their calling. They deserved to be killed by the king. (S.S. I. 3).

With the rise of other schools of medicine, we have two classes of physicians, those who followed the school of Ātreya, the physicians proper, and those who followed the school of Dhanvantari, and the surgeons. Besides these physicians and surgeons, we have reference also to a third class, that is physicians to the king (court physicians). This was the highest honour a physician could aspire to. They were attached to the king's court and Susruta describes their duties (S.S. I. 34). The king's physician was assigned certain special tasks. He had to collaborate with the house priest. The physician by his knowledge of medicine and the priest by his knowledge of incantations should carefully and constantly protect the king from death by deranged humours or accidents. The prudent physician should always act according to the wishes of the priest. We see that by the time of Susruta the functions of the priest-physician have undergone a complete division. The priest and the physician have become two independent professions. One of the special duties of the king's physician is to safeguard the king against the possibility of being poisoned, a peril from which he was rarely free. In S.S. V.1, we have a special lesson dealing with the daily supervision of the royal kitchen and the dishes served to the king. The king's physician functioned as an army surgeon in time of war. He accompanied the army and stayed closely by the side of the king, protecting him from poisoning, and purifying wells, food, etc. He had to occupy a large tent close to that of the king, equipped with all the necessary articles for treatment. Patients suffering from poison, wounds or disease should come with confidence to the physician there located,

trusting in his fame and reputation. Learned in his own sâstras and acquainted with the other sâstras, he shone as a banner and was to be respected like the king. (S.S. I. 34). No wonder this position of a court physician was coveted so much.

From the Bower Manuscript it would appear that further specialisation had taken place. We read of children's physicians, such as Jivaka and Kasyapa, and also of eye-surgeons like Nimi. Special works on these subjects are attributed to these physicians. The reputation of the army physician was so great that Alexander gathered the most expert Indian physicians in his pavilion in order to cure serpent-bites and other ailments.⁶³

In Charaka (I. 29.11) we have mention of "consultant physicians". We do not know whether they formed a separate class or not.

THE ETHICS OF THE PROFESSION

The high status of the physician and the respect he commanded led to careful guarding of the ethics of the profession. This was achieved through the long and thorough training demanded. The choice of the profession of medicine was conditional, as we have seen, upon good descent, preferably from a medical family, and possession of certain physical, moral and intellectual endowments. Only reputed preceptors of high standing and learning could entertain pupils. The reputation of the preceptor depended upon the conduct and character of his pupils. As we have seen, at the initiation, in the presence of priests and physicians, the pupil took a vow, the fulfilment of which was considered a sacred duty, that he would truly observe the religious duties and the prescribed commands of the profession. The respect to religion and the high reputation the profession enjoyed were the considerations which kept its ethics at a high level. Susruta mentions another restraining influence, the need for a permit to practise from the king. When the pupil had finished his apprenticeship, he received this permit on the recommendation of his master. A permit from the king was necessary to prevent quacks from entering his kingdom, where they might prove a public calamity, says Dallana. Susruta remarks that quacks were allowed to exist or practise owing to the carelessness of the king. Physicians who were not properly trained and qualified were not to be allowed to practise their calling. Indeed, they deserved to be killed by the king. (S.S. I. 3). It is quite evident that this control must have become very lax as the number of quacks proved a public calamity. Charaka is very severe on them. He

speaks of them as "cheats who wander about on the streets boasting in the garb of physicians". As soon as they heard of a patient, they hurried there and boasted loudly of their medical capacities so as to reach his ears. They tried to win over his friends by all sorts of attentions and emphasised that they would be satisfied with small remuneration. When they treated a patient and were not able to allay his pain, they asserted that he did not take the necessary remedies, disobeyed their directions and could not control his desire. When the case was hopeless they ran away. They boasted of their skill before uneducated people, and by doing so only betrayed their ignorance. They avoided assemblies of learned people, just as a traveller avoids a dangerous forest. Nobody knew who was their teacher, pupil or fellow pupil (C.S. I. 29.11). Such quacks were particularly responsible for the bad reputation of physicians. Again and again we read protests against lack of long and thorough training, the implication being that an ignorant physician will be more of a quack than a scientifically trained one. The medical profession and patients are warned against these quacks. Charaka says, "These men who, wearing the garb of physicians, seek to gratify afflicted persons like fowlers seeking to capture birds in the woods by having recourse to their nets or springes, those men who are unlearned in scriptures, experience, (knowledge of) curative operations, time, measure and place, should be avoided. They walk on the earth like the followers (messengers) of death. A wise patient should always avoid those foolish men with a show of learning who, for earning their sustenance, pretend to the honour of being physicians. They are like snakes subsisting on air. Salutations of reverence are ever due to able physicians who are conversant with the scriptures, possessed of cleverness, endowed with purity of behaviour, skilled in treatment of disease, of practised hand, and with souls under complete control." (C.S. III. 8).

With regard to the conditions of practice of the physician, no mention is made in the *samhitas* of hospitals or other places where the sick were attended to. Hospitals came into existence later, in the time of Asoka, 274-236 B.C. The physician seems to have treated the patient only in his house. We have a mention of the four requisites for the success of treatment. These are: the physician, the patient, the medicines, and the attendant on the sick. We do not know whether there was a separate profession of nurses or not, or what was the sex of the sick-attendant. Most probably the sick-attendants were males. Their qualifications are laid down. They should be amiable, capable of

preserving secrets, strong in body and devoted to the care of the sick. They should carry out the orders of the physician and never be tired (S.S. I. 34). Charaka mentions some other of their duties. They should be of good behaviour, distinguished for purity or cleanliness of habits, attached to the person for whose service they are engaged, possessed of cleverness and skill, full of kindness, skilled in every kind of service the patient may require, generally clever, competent to cook food and curries, skilful in bathing or washing the patient, well conversant in massaging or pressing the limbs, or raising the patient, or assisting him in walking or moving about, well skilled in making or cleaning beds, competent to pound drugs, ready and skilful in waiting upon one that is ailing and never unwilling to do any act that may be commanded (by the physician or the patient) (C.S. I. 15.7). As we have seen, Sūsruta remarks that a physician should have an attendant of good character. Perhaps these attendants were used as the attendants on the sick.

The physician did not go without remuneration for his services. In spite of the altruism inculcated in the oath, he looked forward to fees and other rewards. A physician mentioned in the Rigveda (R.V. X. 97), desires to receive a horse, cattle and clothing, for his skill with his healing herbs. He also expects rich fees.

Another hymn in the Rigveda states : "A poet who is a poet, physician and apothecary in one person journeys about the country, conveying with him in a wooden box all sorts of healing herbs and applying his vocation not without humour, especially with a frankness that merits recognition. He makes no secret of the fact that it is not altogether philanthropy which urges him to practise, but that gain is his main motive."⁶⁴

The highest aim of a physician seems to have been to treat a king and become his court physician. These court physicians must have been well paid and lived in affluence. Jivaka Kumar Bachha, a contemporary of Buddha and physician to Bimbisara, received very high fees for his wonderful cures.⁶⁵ The fees do not seem to have been always in cash, but were mostly in kind. Charaka was the trusted physician of King Kanishka.

CHAPTER I

ANCIENT INDIAN ANATOMY

No serious attempt has hitherto been made to assess the extent and accuracy of the knowledge of anatomy possessed by the ancient Indian medical writers. Our knowledge of this subject is, therefore, extremely limited. This is responsible for some strange views expressed on the subject. Indian anatomy consists of "fanciful enumerations of the unimaginable parts of the body" naïvely asserts Garrison.¹ "It is characterised by a juggling with figures wherein the numbers 5 and 7 play the chief part" writes Neuburger.² Hoernle, however, to whom we owe the only published critical study on the subject, particularly on osteology, discovers a vast amount of anatomical knowledge in the works of the earliest Indian medical writers. "Its extent and accuracy", he says, "are surprising when we allow for their early age—probably the sixth century B.C., and their peculiar methods of definition."³

Anatomy seems to have been studied in India from very ancient times. The existence of an anatomical tradition can be traced back to the Vedic period. In the Rigvedic Hymns we find mention made of the lungs, the heart, the stomach, the intestines, the kidneys and other viscera. The Atharva-veda evinces a thorough knowledge of the coarser anatomy of the human body. Thus in Book X. 2 we have a hymn entitled "The wonderful structure of man" in which the several parts of the skeleton are carefully and systematically enumerated, in striking agreement with the Ātreya-Charaka system. In Book II. 33 almost all the important organs mentioned by the later Ātreya-Charaka and Susruta schools are enumerated. In course of time this anatomical tradition crystallised into definite knowledge. With the rise of the various schools of medicine, Indian anatomy entered on its scientific phase. It was diligently studied in these schools and a vast amount of facts about the human body was collected. No satisfactory knowledge of human anatomy can be attained without recourse to human dissection, and in the *samhita* of Susruta we have direct proof that this was practised in ancient

India. "Anyone who wishes to acquire a thorough knowledge of anatomy must prepare a dead body and carefully observe and examine all its different parts." (S.S. III. 5. 49). But their method of dissection was curious and very crude and is thus described by Susruta "one should select a body which is complete in all its parts. It should also be the body of a person who was not excessively old nor who died of poison or of a protracted disease. Having removed all the excrementitious matter from the entrails, the body should be wrapped in grass and placed in a cage. Having firmly secured the latter in a hidden spot in a river, the body should be allowed to decompose. After an interval of seven days, the thoroughly decomposed body should be taken out and very slowly scrubbed with a whisk made of grass roots. At the same time, every part of the body, great or small, external or internal, beginning with the skin, should be examined with the eye, one after the other as it becomes disclosed in the course of the process of scrubbing." (S.S. III. 5. 50-56). Knowledge thus gained from dissection was supplemented by observations gained from the practice of surgery. "Collection and observation of facts constitutes the first step in science but not science itself. The economic requirements of the human intellect necessitate a grouping of isolated facts from the different points of view." ⁴ So in the evolution of Indian anatomy we find the vast accumulation of facts and observations concerning the human body getting systematised into various schools of anatomical thought. Well known among these were the schools of Ātreya-Charaka and Susruta. Both Charaka and Susruta devote a complete section of their *samhitas*—*Sarira Sthāna* to the subject of anatomy. In these sections, besides anatomy proper, embryology and histology are also dealt with. This reveals a conception of anatomy as comprehensive as that of modern medical science. The histology of the Indian anatomists, as is to be expected in the absence of the microscope, is mainly speculative and metaphysical.

EMBRYOLOGY

THE EMBRYO AND ITS FORMATION : The formation and development of the embryo was a subject of considerable speculation and controversy in the various schools of medicine. The opinion of Charaka and Susruta with regard to the part played by the male and the female in the formation of the embryo is that both the male and female contributed seed. The "secretion" of the male is called the *sukra* (semen). It is secreted for originating

conception (C.S. IV. 2. 3) and is derived from the food by way of the blood. Blood is produced from *rasa*, flesh from blood, fat from flesh, bones from fat, marrow from bones and finally *sukra* (semen) from marrow. It is the most important essence of all the ingredients composing the body and pervades all parts of the body. The semen passes through the ducts situated about two fingers' breadth on either side of and just below the neck of the bladder and finally flows out through the canal (of the bladder). (S.S. III. 4. 21. 23). The "secretion" of the woman is called *artava* or *sonita* and it is derived from food by way of blood. It is carried by two *dhamanis* to the uterus. Where there is a union between a man with effective *sukra* (semen) and a woman whose generative organ, uterus, and *sonita* have no defects and if at the time of the union the soul comes in touch with it through the mind the embryo is formed. The embryo furnished with juices agreeable to it, nourished by proper nourishment and free from disease begins to grow. (C.S. IV. 3. 2). It is by the combined effect of all the above elements that an embryo is produced and not by any one of them separately. Just as a house is made up of various kinds of things or just as a chariot is made up of a collection of its various parts, so is the embryo made up of the combination of various elements which contribute to its formation and development. The forms that the embryo-producing elements assume depend upon the form of that particular species in whose womb they assemble. Just as gold, silver, copper, lead and tin assume the form of any mould in which they are poured, so when the causal elements already mentioned enter into a human mould, they take birth in human shape. (C.S. IV. 3. 25 & 28). In the embryo, from which the body springs, there are particular portions from which particular "limbs" grow. Each of the elements of which it is composed makes its own particular contribution to it. Those which it derives from the mother are skin, blood, flesh, adeps, navel, heart, lungs, liver, spleen, breasts, pelvis, stomach, intestines and marrow. Those which it derives from the father are hair (of the head), nails, teeth, bones, nerves, sinews, arteries and semen. Deformities may be mother-born, father-born or embryo-born. One or more of the "limbs" that are mother-born becomes subject to deformity when the *sonita* and the uterus are vitiated. Similarly, in consequence of defects in the father's semen deformities appear in those limbs which are father-born. (C.S. IV. 3. 8. 10). While the embryo is in the womb, a defect of any particular "limb" may arise due to some defect in that part of one or more of the operating causes through the influence

of which that part was produced. The child does not owe his sense organs to his parents. He alone is responsible for them as these are born of his self. The presence or absence of the sense organs is dependent on the acts of his previous births. Hence the child born of idiots or parents with defective senses need not necessarily resemble his progenitors. (C.S. IV. 3. 30).

Concerning the mechanism of sex determination, the Indian anatomists held that this took place at the time of fertilisation. If the blood (*sonita*) predominates (in the embryo) the result is a girl; if the semen (*sukra*) predominates it is a boy. A hermaphrodite is born of an embryo that consists of semen and blood in equal measure or of semen whose productive power has been burnt up. If the seed becomes divided into two or more portions then two or more children are born. The relative predominance of the *sukra* or the *sonita* in each of these embryos determines the sex of the individual embryo. (C.S. IV. 3. 11 and 12).

FOETAL DEVELOPMENT

In the first month the foetus has a jelly-like form (*kalala*). In the second month, the material constituents of the body having undergone a chemical change due to the action of cold, heat and air, the foetus becomes hard (*ghana*). If it is the foetus of a male child it is spherical (*piṇḍa*); if of a female child it is elliptical (*peṣī*); if it is of a hermaphrodite it is like the half of a solid sphere (*arbuda*). In the third month five special eminences are seen, as also the slight differentiation of limbs. In the fourth month the differentiation of the limbs is much more definite and well manifested; and owing to the manifestation of the heart, consciousness also comes into existence, since the heart is the special seat of consciousness; so from the fourth month the foetus manifests a desire for objects of the senses. In the fifth month the consciousness becomes more awakened. In the sixth month intelligence begins to develop. In the seventh month the division and differentiation of limbs becomes complete. In the eighth month the vital element (*ojas*) still remains unsettled, so if a child is born at this time it is short lived. The parturition takes place either in the ninth, tenth, eleventh or twelfth month of conception. (S.S. III. 3. 14 and 16). But according to Charaka, parturition takes place either in the ninth or tenth month. In the Garbha Upanishad, the date of which is unknown, a different description of foetal development is given. By the second night after the union:

of the semen and blood, the foetus is of the form of a round lump called *kalala*; by the eighth night it is of the form of a vesicle called *budbuda*; after a fortnight it assumes the form of a spheroid, *pinḍa*; in two months the head appears; in three months the feet; in four months the abdomen, heels and pelvic portions appear; in the fifth month the spine appears, in the sixth the mouth, nose, eyes and ears develop; in the seventh the foetus becomes endowed with life; in the eighth it becomes fully developed.⁵ The pregnant woman who seems to hold the foetus on the left side (of the womb) and whose womb does not swell all round produces a female child; she who seems to hold it on the right side produces a male; and she the middle part of whose abdomen becomes sunk or divided like a leather bag will give birth to twins. (S.S. III. 3. 20).

Diversity of opinion seems to have prevailed among the authorities about the limbs of the foetus and the priority or otherwise of their appearance. It is the head that is first formed in the womb, observes Kumārasira-Bharadwāja, as the head is the seat of all the organs of sense. The well-known physician Kānkāyana-Bālhika considers that it is the heart which is first formed since it is the seat of *chetana* (consciousness). The navel it is that is first formed considers Bhadrakāpya, since it is the place where food is received. It is the intestines that are first formed since they are the place where the *vāyu* in the body has its seat, considers Bhadra-Saunaka. The hands and feet are first formed, considers Badisa, since they are the instruments by which one performs all acts. The senses are formed first, considers Videha Janaka, since they are the seats of the understanding. In consequence of the subject being out of the ken of the senses, it cannot be ascertained, maintains Kāsyapa (C.S. IV. 6. 26). Dhanvantari holds that the development of all the parts of the body of an embryo goes on simultaneously and they cannot be perceived or detected in the earlier stages of development in the womb owing to their extremely attenuated size. Just as the juicy parts and the stone, which are undifferentiated in a green mango at its early stages, are found clearly developed and differentiated when it is ripe, so, when the human foetus is even in the early stages of development all its undifferentiated parts are already developing there *pari passu*, though on account of their fineness of structure and growth they cannot then be distinguished. (S.S. III. 3. 18). Charaka asserts that all the organs of sense, as also the form of all the limbs which grow before birth, make their appearance simultaneously in the third month. (C.S. IV. 4. 10).

According to the Indian anatomists, the growth of the embryo takes place by a process of stratification in which several layers are superimposed one upon another. The stratification commences with the skin and is brought about by the action of cold, heat and air. Seven different layers (*kalās*) of the skin are formed and deposited on the rapidly transforming product of the combination of *sukra* and *sonita*, in the same manner as layers (of cream) are formed and deposited on the surface of boiling milk. The seven layers of the skin are *avabhāsini*, *lohita*, *svetā*, *tāmrā*, *vedini*, *rohini*, and *māmsadharā*. Besides these, there are also seven layers (*kalās*) between the different *dhātus*. "A *dhātu* is that which supports or sustains the body, such as chyle (*rasa*), blood (*rakta*), flesh (*māmsa*), fat (*medas*), bone (*asthi*), marrow (*maiija*), semen (*sukra*), and the vital fluid (*ojas*). Lymph (*kapha*), bile (*pitta*) and excreta (*purisha*) have also to be counted as *dhātus*. These *kalās* are supposed to divide the layer of one *dhātu* from another and are covered with lymph and tissues. In the first *kalā*, known as *māmsa-dharā*, the veins, tissues of the flesh are found; in the second, the *rakta-dharā*, is found the blood inside the flesh; in the third called *medo-dharā* there is the fat which is found in the abdomen and also between the smaller bones. The fourth *kalā* is the *sleṣma-dharā* which exists in the joints; the fifth is the *purishadharā* which exists in the intestines and separates the excreta; the sixth and seventh are the *pitta-dharā* and the *sukra-dharā*." (S.S. III. 4. 26). The viscera are formed, according to Susruta, from the blood, some out of its essential and others out of its non-essential parts, by the action of heat of the *pittam*. The spleen and liver are formed out of blood; the lungs are made out of the froth of blood; and the *unduka* (faecal receptacle) from the dirt (*māla*) of the blood. The intestines, bladder and rectum are formed out of the essence of the blood and *kapha*. The tongue is made of the essence of the flesh, blood and *kapha*. The kidneys are made out of the essence of the blood and fat. The testes are formed out of the essence of the blood, flesh, *kapha* and fat. The heart is formed out of the essence of blood and *kapha*. (S.S. III. 4. 25-31).

OSTEOLOGY ⁶

Our knowledge of the views of the ancient Indians regarding the human skeleton is derived from two different sources: medical and non-medical. The medical versions are derived from the compendiums (*samhitas*) of Charaka, Bhela, Susruta

and Vāgbhāṭa I. The non-medical versions are derived from Yājñavalkya Dharmasāstra, Vishnu Smṛiti, Vishnu Dharmottara and Agni Purāṇa. Of the four medical versions, those of Charaka and Bhela are identical and are based on the version of Ātreya which is contained in the Charaka Samhita. The version of Susruta differs in many essential details from that of Ātreya and so must be regarded as an independent one. The version of Vāgbhāṭa I contains no essential characteristics of its own. It is a compromise between those of Ātreya and Susruta. The non-medical versions in their essential features resemble that of Ātreya. So the various versions on a careful scrutiny can be divided into two main systems : that of Ātreya-Charaka and that of Susruta.

THE ĀTREYA-CHARAKA VERSION : The body consists of the following parts (*anga*) : the two arms (*bāhu*) ; the two legs (*sakthi*) ; the head and neck (*siro-grīva*) and the trunk (*antarādhi*). These make up the sexpartite (*ṣadanga*) body. Inclusive of the teeth and nails, it has three hundred and sixty bones. There are 32 teeth (*danta*) ; 32 sockets (*ulūkhala*) of the teeth ; 20 nails (*nakha*) ; 60 phalanges (*anguli*) ; 20 long bones (*salākā*) ; 4 bases of the long bones (*salāk-ādhisthāna*) ; 2 heels (*pārsni*) ; 4 ankle-bones (*gulpha*) ; 4 wrist-bones (*manika*) ; 4 bones of the forearms (*aratni*) ; 4 bones of the legs (*jangha*) ; 2 knee caps (*jānu*) ; 2 elbow-pans (*janu-kapālikā*) ; 2 hollow-bones (*nalaka*) of the thighs (*ūru*) ; 2 hollow-bones (*nalaka*) of the arms (*bāhu*) ; 2 shoulder-blades (*amsa-phalaka*) ; 2 collar bones (*akṣaka*) ; 2 hip-blades (*sroni-phalaka*) ; 1 pubic bone (*bhag-āsthi*) ; 45 back bones (*prṣṭha-gatāsthi*) ; 14 bones of the breast (*uras*) ; 24 ribs (*pārsvaka*) ; 24 sockets (*sthālaka*) of the ribs ; 24 tubercles (*arbuda*) fitting into the sockets ; 15 bones of the neck (*grīvā*) ; 1 wind-pipe (*jatru*) ; 2 palatal cavities (*tāl-ūśaka*) ; 1 (lower) jaw bone (*hanu-asthi*) or chin ; 2 basal tie-bones of the jaw (*hanu-mūla-bandhana*) ; 1 bone constituting the nose, prominences of the cheeks and brows (*nāsikā-gandakūta-lalāta*) ; 2 temples (*sankha*) ; 4 cranial pan-shaped bones (*sirah-kapāla*). Total : 360 (C.S. IV. 7. 4-6 as restored by Hoernle.)⁷

SUSRUTA'S VERSION : "The Professors of general medicine speak of 360 bones ; but books on surgical science know only of 300. Of these there are 106 in the extremities ; 128 in pelvic cavity, sides, back, shoulder and breast ; and from the neck upwards, 66. In this wise the total of the bones is made up. Now in each toe of the foot there are three bones ; this makes altogether 15. Those bones which constitute the sole cluster, and

COMPARATIVE TABLE OF ANCIENT INDIAN AND MODERN SYSTEMS*

A. — FOUR EXTREMITIES

	<i>Modern</i>	<i>Charaka</i>		<i>Susruta</i>	
		Pāni-pād-ānguli	60	Pāni-pād-ānguli	60
1. Phalanges, or joints of fingers and toes ..	56	Salākā	20	Tala	20
2. Metacarpus and Metatarsus, long bones ..	30	Adhisthāna	4	Kūrcha	4
3. Carpas and tarsus, clun- ters, or bases ..	4	Pārsni	2	Pārsni	2
4. Os calcis, heel ..		Aratni	4	Aratni	4
5. Forearm (Radius, ulna) ..		Manika	4	Manibandha	2
6. Styloid processes wrist- bones ..		Kapālīkā	2	Kūrpara	2
7. Olecranon, elbow-pan	4	Jangha	4	Jangha	4
8. Leg (tibia and fibula)		Gulpha	4	Gulpha	2
9. Malleoli, ankle bones	2	Jānu	2	Jānu	2
10. Patella, knee cap ..	2	Bāhu-nalaka	2	Bāhu	2
11. Arm (humerus) ..	2	Ūru-nalaka	2	Ūru	2
12. Thigh (femur) ..	2				
Total ..	120	Total	110	Total	106

C. — HEAD AND NECK

<i>Modern</i>	<i>Charaka</i>		<i>Susruta</i>	
22. Cērvix : Vertebrae- Neck bones	7	Grīvā	15	Grīvā
23. Trachea, bronchi, windpipe	..	Jatru	1	Kanṭha-nādi
24. Cranium				
Frontal	1	Sirah-kapāla	4	Sirah-kapāla
Parietal	2			
Occipital	1			
Sphenoid	1			
Ethmoid	1			
25. Temporal	2	Sankhaka	2	Sankha
26. Face				
Superior maxillary	2	Hanu, hanumūla	3	Hanu
Inferior maxillary	1			
Superciliary ridges, brows	1			
27. Malar.	2	Ganda-kūta Nāsikā	1	Ganda Nāsā
28. Nasal	2			

29. Palate bones	..	2	Tālūṣaka	..	2	Tālu	..	2
Lachrymal	..	2						
Inferior turbinated	..	2						
Vomer	..	1						
Hyoid	..	1						
30. Additional :								
Teeth			Danta	..	32	Danta	..	32
Sockets of teeth			Ulūkhala	..	32	Akṣi-kosa	..	2
Nails			Nakha	..	20	Karna	..	2
Eyeballs								
Ears								
Total	..	30	Total	..	112	Total	..	66
Grand Total	..	200	Grand Total	..	360	Grand Total	..	300

* (Medicine of Ancient India, Part I, Osteology, pp. 118 and 119.)

ankles are 7. In the heel there is one ; in the leg there are two ; in the knee there is one ; there is also one in the thigh. Thus there are 27 bones in one lower limb. The same count applies to the other lower limb, and similarly to the two upper limbs. In the pelvic cavity there are 5 bones. Of these, there are four in the anus, pubes and hips ; the fifth constitutes the triangular sacrum. There are 36 bones in one side ; and as many in the other. In the back there are 30 ; 17 in the breast ; 2 each in the collar bone and shoulder blades ; 9 in the neck ; 4 in the wind pipe ; and 2 in the jaws. The teeth number 32 ; in the nose there are 3 ; 2 in the palate ; one each in either cheek, eye, ear and temple and 6 in the cranium." (Susruta S. II. 5. 17-20 as restored by Hoernle).⁸

The Indian anatomists divided the body into six parts, the four extremities, the head and neck, and the trunk. There are two hundred bones in the adult human skeleton excluding the ossicles of the ear. The Indian anatomists counted either three hundred and sixty (Ātreya-Charaka) or three hundred (Susruta). This enormous variation in number is due to the fact that they included the teeth, nails, and cartilages in their count and, what is more important, they counted prominent parts of bones such as the "processes" and the "protuberances" as separate bones. This led to the multiplication of bones. But in their enumeration of bones the opposite process of unification also occurs. Collections of bones like the carpal and tarsal bones were counted as single bones.

THE PHALANGES (Pāni-pād-āṅguli) : Both Ātreya-Charaka and Susruta count sixty phalanges i.e. thirty in the two hands and thirty in the two feet. The actual number is only fifty-six, there being only two phalanges in the thumb and the great toe, but they counted three in each of these "on fancied claims of symmetry."

THE METACARPAL AND METATARSAL BONES : Charaka and Susruta give the count of these bones as twenty-five on either hand and foot which is the actual number. Charaka names the metacarpals *pāni-salākā* and the metatarsals *pādasalākā*. Susruta calls them *tala* and mentions them along with the carpal, tarsal, and ankle bones (*tala-kūrcha-gulpha*).

THE CARPAL AND TARSAL BONES : Both Charaka and Susruta count these as single bones. Charaka calls them *adhishthāna*. He seems to have considered that the metacarpals and metatarsals were fixed to a single bone as their common base. Charaka was not aware of the composite nature of these bones and considered them single undivided bones. Susruta was

aware of the composite nature of these structures, as is evident from the name he gives them, i.e. *kūrcha*, a cluster. He knew at least one bone of this cluster — the astragalus which he calls the *kūrcha-siras*, the head of the cluster (S.S. III. 6. 36), but curiously enough, he does not count it as a separate bone. Both Charaka and Susruta count the heel (*pārsni*) as a separate bone.

THE STYLOID PROCESSES AND THE MALLEOLI: Charaka counts all these processes as separate bones. He counts four styloid processes (*manika*) and four malleoli (*gulpha*). Susruta, for some unknown reason, counts each pair of styloid processes as one and each pair of malleoli as one and thus he gives the count of styloid process as two and that of the malleoli as two. The *olecranon* process of the elbow was counted as a separate bone by both Charaka and Susruta, but they give different names to it. Charaka calls it *kapālikā* (the elbow-pan); Susruta calls it *kūrpara*.

THE SHOULDER BLADES OR SCAPULA: Charaka calls this bone *amsaphalaka*, the flat bone of the shoulder. Susruta gives many details about it. He notes its triangular shape (*trika-sambaddha*). He mentions two other structures belonging to the *amsaphalaka*, viz., the *amsa-pīṭha*, the shoulder seat (the glenoid cavity) and *amsa-kūṭa*, the summit of the shoulder (the acromion process). (S.S. III. 6. 26).

THE THORAX: Both Charaka and Susruta conceived the thoracic cage as being bounded at the back by the thoracic vertebrae, which were included in the term *pṛṣṭha* (back), the two sides by the ribs denoted by the term *pārsvaka* and the front by the sternum and the costal cartilages which are jointly denoted by the term *uras* or *vakṣas* (breast). Charaka counts fourteen bones in the *uras* or breast. The Indian anatomists, as noted above, counted cartilages as tender bones (*taruna-aṣṭhi*). Charaka counts seven costal cartilages only on each side, whereas they are really ten. The costal cartilages on the 8th, 9th and 10th, being attached to the 7th, were not counted by him as separate bones. Neither does he count the sternum as a separate bone. He seems to have considered it the union of the costal cartilages of the opposite sides. Susruta shows better anatomical discernment when he counts the sternum as a separate bone. He also counts the costal cartilages as eight on each side taking the costal cartilages of the 8th, 9th and 10th as one cartilage. Thus he arrives at the count of $(8 \times 2) + 1 = 17$ bones in the breast. The Indian anatomists followed a novel method in their count of the ribs. As we have seen above, the costal cartilages were counted as separate bones. The actual

number of ribs is twenty-four, but both Charaka and Susruta give the count as seventy-two. This is due to their peculiar method of enumeration of the ribs. The "tubercles" of the ribs were counted as separate bones from the ribs proper. That gave them a count of $24 \times 2 = 48$ bones. The transverse processes of the twelve thoracic vertebrae were considered by the Indian anatomists parts of the system of ribs by reason of their containing the facets for articulating with the ribs. So these processes were counted as separate bones connected with the ribs. Thus each rib, according to them, consisted of three separate bones—the shaft, the tubercle and the transverse process with which it articulated. This method of enumeration gave them the count of $24 \times 3 = 72$ ribs.

THE VERTEBRAL COLUMN: This was counted differently by Charaka and Susruta. Both of them counted the cervical vertebrae as part of the neck and the dorsal and lumbar vertebrae as part of the back. Charaka included the sacrum and coccyx along with dorsal and lumbar vertebrae for his count of the bones of the back, but Susruta included the sacrum and the coccyx in the bones of the pelvic cavity. Charaka counted fifteen bones in the *grīvā* (neck). The cervical vertebrae are not all alike but differ markedly from each other. Charaka counted the transverse processes as separate bones and the bodies of all the cervical vertebrae as one bone "based on a prevalent anatomical tradition." This explains his count of $7 \times 2 = 14 + 1 = 15$ bones in the neck. Susruta, as usual, shows greater accuracy. He counts the bodies of the seven vertebrae as separate bones, but he is puzzled with regard to the count of the transverse processes which vary so much in these cervical vertebrae. The seventh cervical vertebra conforms closely to the pattern of the thoracic vertebrae. He ignores the transverse processes of the first six cervical vertebrae altogether, but counts the two transverse processes of the 7th cervical as separate bones. Thus he arrives at his count of nine bones of the neck $7 + 2 = 9$. Charaka gives a count of 45 bones in the back. There are twelve thoracic vertebrae, five lumbar, the sacrum and the coccyx, and Charaka includes all these structures in his count of the back. Each vertebra consists of a body, a spinous process and two transverse processes. Charaka regards each of these as a separate bone and counts four bones for each vertebra. The sacrum and the coccyx he counts as one bone only. The two transverse processes of the thoracic vertebrae were counted along with the ribs. So, as far as the thoracic vertebrae are concerned, Charaka counts twenty-four bones only. But the five

lumbar he counts as twenty bones. Thus his total of forty-five is derived. Susruta counts thirty bones in the back. He excludes the sacrum and the coccyx, which he counts with the bones of the pelvis. This leaves the twelve thoracic vertebrae and the lumbar vertebrae which Susruta counts as six and not five. "The first sacral vertebra is of a transitional and partly of lumbar character and occasionally remains separate." It is this fact which appears to have caused Susruta to count six lumbar vertebrae. Susruta, unlike Charaka, counts each vertebra as composed of three bones only, counting the body and the spinous process as one and the two transverse processes as separate bones. This count is based on his ideas of the principle of homology. So, for the twelve thoracic vertebrae he counts twelve bones only, as the transverse processes have already been counted along with the ribs. The "six" lumbar vertebrae he counts as eighteen bones and thus his count of thirty bones for the back is derived.

THE PELVIS: Susruta and Charaka differ in their treatment of the pelvic bones. The pelvis is constituted by the two hip bones, the sacrum and the coccyx. Charaka, as mentioned above, counted the sacrum and the coccyx as a single bone, which he included in his count of the bones of the back. The hip bone is not a single bone but consists of three bones, the ilium, the ischium and the pubis. The two pubic bones meet in front and form the pubic arch. Charaka and Susruta seem to have counted the pubic arch as one bone and called it the *bhagāsthi* (the bone of the pubis). The remaining portion of each hip bone was called the *sroni-phalaka*, the flat bone of the pelvis. Thus Charaka counted three bones in the pelvis, the two *sroni-phalakas* and one *bhag-asthi*. Susruta counted five: the two *sroni-phalakas* which he called the *nitamba*, one *bhag-asthi* (or the pubic bone), one *trika* (sacrum) and one *guda* or *gudāsthi* (the coccyx or the anal bone). This agrees with the actual constitution of the pelvic cavity. Unlike Charaka, he counted the sacrum and the coccyx as separate bones and he also used the descriptive term *trika* for the sacrum. The sacrum of Susruta consists of four pieces only and not five, as he counted the first piece of the sacrum along with the lumbar vertebrae.

THE CRANIUM: The cranium is made up of eight bones—the frontal, the two parietals, the two temporals, the occipital, the sphenoid and the ethmoid. The ethmoid and the sphenoid, including that small portion of it which shows externally by the side of the frontal, were unknown to the Indian anatomists. The temporals were correctly counted as two by both Charaka and

Susruta. There remain then four bones—the frontal, the two parietals and the occipital. Charaka counts them correctly as four, naming them *sira-kapāla*—pan-shaped bones of the head. Susruta gives the number of *sira-kapāla* as six. He considers the occipital and frontal bones as being composed of two halves each, and each half he counts as a separate bone following his principle of homology.

THE WINDPIPE: Susruta calls the windpipe *kaṇṭha-nādi*; and Charaka *jatru*. It consists of four parts: the larynx, trachea and two bronchi. These structures are not bones at all but are made of cartilage, but the Indian anatomists counted cartilages as bones. Charaka counted the windpipe as one bone; Susruta, on the other hand, counted it as four.

THE FACIAL BONES: The face is composed of the following bones: two maxillary, two palatal, two malar, two nasal, two lachrymal, two inferior turbinates and one vomer. Of these the Indian anatomists were not aware of the existence of the palatal, lachrymal, inferior turbinates and vomer. Charaka and Susruta differ widely in their enumeration of the rest of the bones of the face. There are two superior maxillary bones and one inferior. Each superior maxillary consists of a body, the palatine process and the alveolar process. Susruta counts the two maxillary bones with the exception of the palatine processes as one bone and calls it the (upper) jaw (*hanu*). The inferior maxillary he counts as a single bone and calls it the (lower) jaw (*hanu*). The two palatine processes (*talū*) he counts as two separate bones. He counts correctly two malars (*ganda*). The two nasals he counts as one bone and the two nasal lateral cartilages he counts as two bones and thus he gives the count of the nasal bones (*nasa*) as three. Charaka counts the palatine and the alveolar processes of each superior maxillary as separate bones. The bodies of the two superior maxillary bones with the two malars, the two nasals and the two superciliary ridges he counts as a single continuous bone (*nāsikā-ganda-kūṭa-lalāṭa*). The inferior maxillary consists of a body and two rami. The body itself consists of three portions, the alveolar process above, the base beneath and the mental protuberance or chin in front. Charaka counts the inferior maxillary as four separate bones (1) the alveolar process (*dantolūkhala*), (2) the base with the chin (*hanu-asthi*—the chin bone) and (3) and (4) the two rami (*hanu-mūla bandhana*—bands at the root of the jaw bone). It must be mentioned that the palatal bones of the Indian anatomists correspond to the palatine processes of the two superior maxillary bones and not to the

real palatal bones. The alveolar processes of both the superior and inferior maxillary bones are subdivided into thirty-two teeth sockets, one for each tooth, and each socket is counted as a separate bone by Charaka.

Susruta classified bones into five kinds ; *kapāla* (flat) ; *ruchaka* (sharp) ; *taruna* (tender) ; *valaya* (circular) ; and *nalaka* (reed-shaped). The flat bones occur in the knees, elbows, hips, shoulders (*amsa*), cheeks, palate, temples, inter-iliac space (sacrum) and cranium. The sharp bones are the teeth. The tender bones occur in the nose, ears, neck (the *jatru* or *kaṇṭha nādi*, the windpipe in the neck), and eye-balls (*akṣi-kosa*). The circular or curved bones occur in the hands, feet, sides, back, abdomen and breast. The remainder of the bones are termed "reed-shaped". The functions of the bones and the skeleton were fully realised by Susruta. "As trees are supported by the hard core inside their trunks, so the body is supported by the firm bones. Muscles are attached strongly to the bones by means of the vessels (*sirā*) and ligaments (*snāyu*) and are thus kept in position and do not fall off." (S.S. III. 5. 21-22).

Charaka gives the number of joints as 200 and has nothing more to say about them. But Susruta possessed remarkably accurate knowledge with regard to them. There are 210 joints in the body. Of these 68 are in the four extremities, 59 in the trunk and 83 above the shoulder (that is, in the neck and head). In each toe there are 3, except the great toe which has two joints, thus making 14 in each foot. The knee, ankle and hip have each a joint. So one leg has 17 joints ; the other leg likewise, as well as both the arms. In the pelvis 3 ; in the spinal column 24 ; in the sides (ribs) 24 ; in the breast 8 ; in the neck 8 ; in the trachea 3 ; in the conjunction joints of the heart and lungs 18 ; in the sockets of the teeth 32 ; 1 in the thyroid cartilage (*kakalaka*) and 1 in the nose ; 2 between the eye-sockets and the eye-balls ; in the malar, temporal and the ears 6 ; in the jaw-bones 2 ; on top of the brows 2 ; 2 above the temples ; in the cranium 5 and 1 in the forehead. He further mentions 14 joints of more than 2 bones (*samghata*). "The *asthi-samghatas* are 14 in number. Of these one is found in each of the following positions, viz., the two ankles, the two knees, and the two hip joints ; of the remaining eight, six are to be found in similar positions of the upper extremities, viz., one in each of the wrists, elbows and shoulder joints ; one is in the cranium and another in the sacral region." "The joints are broadly divided into two groups—the movable and the immovable. In the four extremities, in the jaws and the loin, the

joints are movable ; the others are known to be immovable by the learned." These joints are again described as of eight kinds.

1. *Kora* (hinge-joint) are the joints in the fingers, wrists, ankles, knees and elbows.

2. *Ulūkhala* (mortar-like in shape i.e., ball and socket joint) are the shoulder joint, hip-joint and teeth sockets.

3. *Sāmudga* (cup-like) are the sterno-clavicular joint, sacro-iliac joint, symphysis pubis and the lumbo-sacral joints.

4. *Pratara* (raft-life) are joints of the neck and the spinal column.

5. *Tunna-sevani* (sewing) are the temporal and the cranial joints.

6. *Vāyusa-tunda* (crow-back) are the joints on either side of the cheek.

7. *Mandala* (circular) : trachea, heart, eye and lung-joints are of this type.

8. *Sankhāvarta* (involutions of conch-shell) are the ear and nose joints.

The names of the joints corresponded to their shape. (Susruta III. 5. 23, 29).

MYOLOGY

Charaka's knowledge of the muscles was very rudimentary. In his count of the 56 minor limbs of the body he mentions two "masses of flesh" of the two *janghas* (lower legs), two of the thighs and two of the two upper arms. It is evident from the above that no attempt was made to distinguish the component parts of the fleshy masses of the legs, thighs and arms. Though he gives the number of muscles of the body as 500, he remarks that the number is not ascertainable by count but is only a matter of inference.

Susruta not only gives the total number of muscles but also their distribution. However, his knowledge of the muscles was much inferior to his knowledge of the bones. "The muscles number 500 in all, of which 400 are in the four extremities ; 66 in the trunk and 34 in the region above the clavicles. There are 3 muscles in each of the toes, thus making 15 in the toes of one leg ; 10 in the forefoot ; 10 in the heel ; in the ankle and sole 10 ; between the ankle and the knee 20 ; 5 in the knee ; 20 in the thigh ; 10 in the hip joint ; thus in one lower extremity there are 100 muscles ; so in the other lower extremity and the two upper arms. In the pelvis 3 ; in the penis 1 ; in the

perineum 1 ; in the testes 2 ; in the buttocks 5 each ; in the upper part over the bladder 2 ; 5 in the abdomen (*udara*) ; in the navel 1 ; in the upper back 5 longitudinal (muscles) on each side ; in the sides (of the spinal column) 6 ; 10 in the breast ; in the shoulder 7 ; 2 in the region of the heart and stomach ; 6 in the region of the liver, spleen and colon. In the back part of the neck 4 ; 8 in the jaws ; in the thyroid cartilage (*kākalaka*) 2 ; in the palate 2 ; in the tongue 1 ; in the cheeks 2 ; in the nose 2 ; 2 in the eyes ; in the front of the neck 4 ; in the two ears 2 ; 4 in the forehead and 1 on the top of the head.

A woman has 20 more muscles than man ; 10 in the two mammae, 5 in each, which are developed in adolescence ; in the vagina 4, two in the entrance and two in the interior ; in the uterus 3 ; and 3 along the passages of the semen and menstrual blood.

Corresponding to the muscles of males that have been mentioned as in the penis and scrotum are the muscles which cover the interior reproductive organs of women.

The muscles are grouped according to their position : isolated, thick, thin, extensive, globular, short, long and cylindrical, hard, soft, smooth and rough ; and they cover the joints, bones, arteries, and nervous fibres according to their respective needs." (Susruta III. 5-37-45).

COMPARATIVE TABLE OF THE MUSCLES OF THE ANCIENT INDIAN AND MODERN SYSTEMS

LOWER EXTREMITY

Number of muscles according to :

Region	Susruta	Modern Textbooks on Anatomy	Remarks
Toe	$3 \times 5 = 15$ }	19	
Forefoot			
Ankle and sole			
Heel			
Leg	20	13	
Knee	5		
Thigh	20	24	
Hip joint	10	..	
Total	100	56	

UPPER EXTREMITY

Total	100	57	
TRUNK			
Pelvic region	3	7	both sides
Perineum	1	11	
Penis	1	..	
Spermatic cord	7	2	
Testis	2	..	
Bladder	2	..	
Abdomen	5	17	
Breast —Heart and stomach region 10+2	12	58	
In the region of liver, spleen and colon	6		
Navel	1		
Shoulder	(7)	(12)	Already included in upper extremity
Upper back	$2 \times 5 = 10$		
Back-sides	6	16	
Buttocks	$2 \times 5 = 10$	(18)	Already included in lower extremity
Total	<hr/> 66 <hr/>	<hr/> 111 <hr/>	

HEAD AND NECK

Back neck	4	14	both sides
Jaws	$2 \times 4 = 8$	8	both sides
Thyroid	$1 \times 2 = 2$..	
Tongue	1	17	
Cheeks	2	2	
Nose	2	10	
Front of neck	4	28	
Eye	2	14	
Forehead	4	2	
Palate	2	8	
Top of Head	1	2	
Ears	2	18	
Larynx	..	19	
Pharynx	..	12	
Mouth	..	16	
Eyelids	..	6	
Total		34	176

The total number of muscles of the body is 513. Susruta gives it as 500; the discrepancy between these two totals is not apparent as they differ only very slightly. But a comparison of the tables of muscles as distributed over the body brings out the fact that the difference between the two systems is great and fundamental. Susruta gives 100 muscles in one lower extremity. From his confirmed belief in homology he takes it for granted that the upper extremity also contains the same number. But according to modern anatomy, the total number is only 57 in the upper extremity and 56 in the lower. With regard to the trunk, and head and neck, Susruta gives the total number as 66 and 34 respectively, whereas the actual number is 111 and 176.

Susruta gives the count of the muscles in each of the extremities as nearly twice the actual number, whereas in both the trunk and the head and neck his count is far short of the actual number. This fact can be explained only by assuming that he duplicated the muscles in his count of the extremities while he failed to differentiate sufficiently the individual muscles composing the various layers of the trunk and head and neck. We have seen that Charaka mentions only "fleshy masses", while

Susruta attempts to distinguish the components of those "fleshy masses". In the extremities the presence of numerous tendons by which the various muscles are attached seems to have puzzled him, or it may be that he deliberately adopts a different method of enumeration of these muscles, counting the tendons as separate from the body of the muscles. In support of this contention we find in Susruta's list 15 muscles for the five toes, 10 at the heel, 10 at the hip joint and 5 at the knee joint. Really there are no muscles in these places, but only tendons. So it is almost certain that Susruta counted tendons as separate muscles. There are altogether 15 tendons in the toes, 11 round the ankle, 6 round the knee and 8 round the hip. Even after deducting the number of these tendons there remain 60 muscles in each extremity. As we have suggested, in the trunk and the head and neck his differentiation of the individual muscles was very deficient. So even these 60 muscles must be made up of further duplication of the existing muscles. The various heads of origin of the muscles of the extremities might have been taken as separate muscles. It will serve no useful purpose to try to reconcile so widely differing lists as those given above of the trunk, and head and neck. The only remark that can be made is that Susruta counted only the more apparent muscles of these areas without making any attempt to differentiate the various muscles, superficial, deep or minute, which occur there. It must be remembered that the count of 513 muscles of modern anatomy includes many minute muscles, the differentiation of which has only been recently achieved.

Besides the muscles (*pesi*), Susruta mentions three other structures, the *snāyus*, the *kandaras* and the *sīmantas*. The *snāyus* are ligaments and their number is given as 900 both by Charaka and Susruta. The *kandaras* are 16 in number and are mentioned separately from the *snāyus*. But in his classification of *snāyus*, Susruta includes the *kandaras*, describing them as large *snāyus*. *Sīmanta* is mentioned only in connection with the *asthi-samghatas* already referred to and probably indicates the synovial capsule and membrane. Occasionally nerves and muscles were confused with ligaments. Thus in S.S. II, 1. 59, in describing the various diseases produced by *vāyu*, Susruta mentions two in which two great *kandaras* which emanate from below the lower extremity of the thigh and reach down to the bottom of the instep and toes, get stuffed or pressed upon by the enraged *vāyu*, depriving the lower extremities of their power of locomotion. Clearly here *kandaras* are used to denote nerve trunks. The ligaments (*snāyus*) are of four kinds : branching, globular,

extensive and perforated. The *snāyus* in the four extremities and joints are branching; the *kandaras* (the large *snāyus*) are globular; the *snāyus* of the anterior parts of the stomach, intestines and bladder are perforated; those of the anterior parts of the stomach and the bladder must obviously refer to the sphincter muscles of these parts. The function of the *snāyus* was clearly understood by Susruta. "As a boat of wooden planks well tied by many knots, can bear the weight of animals and goods in water, so a man can carry weight as his joints are knotted together by the *snāyus*. The body does not suffer as much by the destruction of the bones, muscles or joints as by the destruction of *snāyus*." (S.S. III. 5. 36).

ANGIOLOGY

From very ancient times the Indians possessed considerable knowledge of the heart and the blood-vessels. In the Atharva-veda the heart is mentioned many times and in A.V. X. 8. 43 a reference is made to a "lotus with nine gates". The comparison of the heart with a lotus is very common in Sanskrit literature. In Chāndogya Upanishad the following description of the heart occurs: "In this body there is a little house shaped like a lotus and in that house there is a little space. There is as much in that little space within the heart as there is in the whole world outside. There are one hundred and one "arteries" leading to the heart." ⁹ Again in Subhala Upanishad we read "there is a red mass of flesh in the middle of the breast. Again in the middle of it there is another mass of flesh in the shape of a lotus (white) which is called *dhara*. It expands in various directions. There are ten holes in the heart in which (the five) *pranas* dwell." ¹⁰ In the various hymns of the Atharva-veda we come across *dhamanis*, *sirās*, *hiras*, and *snavas*, words which in later medical literature are used to denote the 'ducts' of the body.

Charaka has nothing much to add with regard either to the description or the structure of the heart, but with regard to the ducts of the body he contributes his own distinctive views. He refers to the view that the body is nothing else but a collection of ducts in order to refute it. The heart is the root of the ten *dhamanis* and these run into every part of the body. He uses all three words *dhamani*, *sirās*, and *srotas* to indicate ducts subserving the same function and denies any distinction between them. He gives the number of *dhamanis* as 200 and of *sirās* as 700, but considers these numbers a matter of inference.

Susruta, as in every other department of anatomy, reveals a more thorough and critical knowledge of the heart and the blood vessels. The heart is of the shape of a lotus bud, hanging with its apex downward (S.S. III. 4-32). The *rasa*, though running through the whole organism, has its primary seat in the heart, whence it flows through the 24 vessels which branch off from the latter to the remotest parts and extremities of the body (S.S. I. 14-3). He describes four kinds of ducts — *vāta*, *pitta*, *kapha* and *rakta-vāha sirās*, giving the number of *sirās* as 700 and of *dhamanis* as 24. Besides these ducts, he speaks of *srotas* which number 22. With regard to the point of origin of these ducts he is not definite. In S.S. III. 9. 3 and S.S. III. 7. 2 he describes the *dhamanis* and the *sirās* as having their origin in the umbilicus, but in S.S. III. 9. 13 he says "The ducts emanating from the cavity of the heart, other than the *sirās* and *dhamanis*, and found to course through the whole body are called *srotas*." Here the heart is indicated as the origin of the *sirās*, *dhamanis* and *srotas*. He explicitly mentions the 24 *dhamanis* as arising from the heart. Again in S.S. III. 4. 30 he mentions the vessels (*dhamanis*) carrying the vital principles of the body attached to the heart.

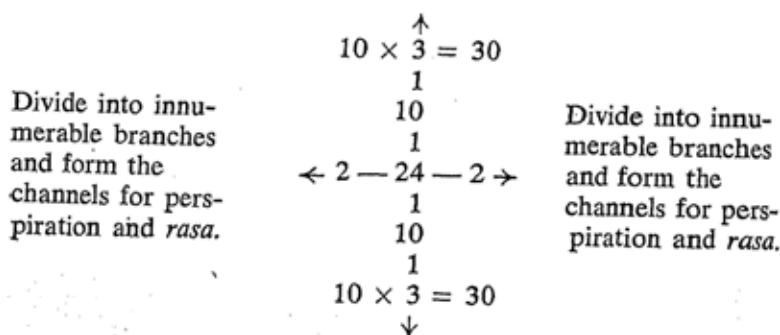
"The total number of *dhamanis* is 24. Of these 10 proceed to the upper part of the body, 10 to the lower part and 4 cross-wise. The 10 which go to the upper part of the body, branch out and are divided into 3 classes thereby reaching the number of 30. Of these 10 serve for carrying *vāta*, *pitta*, *kapha*, *sonita* and *rasa* — 2 for each ; 8 for carrying *sabdha*, *rūpa*, *rasa*, and *gandha*, 2 for each ; 2 for the organ of speech ; 2 for making noises (*gosha*) as distinguished from speech ; 2 for going to sleep ; 2 for being awake ; 2 for bearing tears ; 2 for carrying milk in women and semen in men. It is by these *dhamanis* that the body above the navel (i.e. sides, back, chest, shoulders, hands, etc.) is held fast to the lower part. The carrying of *vāta* etc. is common to all the *dhamanis*.

Those *dhamanis* which branch out downwards are 30 in number. They eject *vāta*, urine, excreta, semen, menstrual blood, etc. downwards. They are connected with the place of *pitta* (*pittāsaya*), draw downwards the materials not fit for being absorbed and nourish the body with the assimilable products of digestion. Those *dhamanis* connected with the *pittāsaya* carry the food-juice throughout the body, as soon as it is digested by the action of heat, by supplying it to the upper circulatory *dhamanis* and through them to the heart which is designated as the seat of *rasa*. Ten *dhamanis* serve to carry *vāta*, *pitta*, *kapha*,

sonita and *rasa*, 2 for each ; 2, connected with the intestines, carry the food-juice ; 2 carry water ; 2 are connected with the bladder for ejecting urine ; 2 for the production of semen ; 2 for its ejection ; and it is these which regulate the menstrual flow in the case of women ; 2 connected with the larger intestines, eject the excreta ; and 8 others which carry perspiration. It is by these *dhamanis* that the intestines, urine, excreta, rectum, bladder and penis are held together.

DHAMANIS · 24

- 30 { 4 — 2 for bearing tears, 2 for milk.
8 — 2 for speech, 2 for sound, 2 for sleep, 2 for walking.
8 — 2 for hearing, 2 for sight, 2 for smell, 2 for taste.
10 — 2 for *vāta*, 2 for *pitta*, 2 for *kapha*, 2 for *rakta*, 2 for *rasa*.



- 30 { 10 — 2 for *vāta*, 2 for *pitta*, 2 for *kapha*, 2 for *rakta*, 2 for *rasa*.
2 carry food-juice.
2 carry water.
2 connected with the bladder for ejecting urine.
2 carry semen.
2 for ejection of semen
(2 for menstrual discharge in women).
2 serve as channels for the excreta.
8 carry perspiration.

SIRĀS 700

40	{	10 <i>kapha</i> -carrying	.. 175	}	70
		10 <i>pitta</i> -carrying	.. 175		
		10 <i>vāta</i> -carrying	.. 175		
		10 <i>rakta</i> -carrying	.. 175		

Distribution of the 175 *vāta*-carrying *sirās* :—

- 25 *vāta*-carrying *sirās* in one leg
- 25 " " other leg
- 25 " " one hand
- 25 " " other hand
- 34 " " *koṣṭha* (trunk)
- 8 in the pelvic region attached to the anus and the penis
- 4—2 in each of the sides
- 6 in the back
- 6 in the cavity of the abdomen
- 10 in the region of the chest
- 41 *vāta*-carrying *sirās* in the region above the clavicles
- 14 occur in the neck
- 4 in the ears—2 in each
- 9 in the tongue
- 6 in the nose
- 8 in the two eyes

175

Each of the other 4 *dhamanis*, which go crosswise, has hundreds and thousands of branches, which, innumerable as they are, are spread all over the body like so many windows; their mouths are at the holes of the hairs, through which perspiration goes out, and which nourish the body with *rasa*. It is through them that the effective principles of oil, watery sprinklings, ointments, etc., enter the body after being acted on by the heat of the skin." (S.S. III. 9. 4. 8). Diagrammatically the above may be represented as on page 25.

The total number of *sirās* is 700, but there are 40 principal ones. Of these 10 are for the circulation of *vāta*, 10 for *pitta*, 10 for *kapha*, and 10 for *rakta*. Each of these groups of ten branches out into 175, making altogether 700. There are 25 *vāta*-carrying *sirās* in each leg and the same number in each

hand. There are 34 in the *koṣṭha* (trunk). Of these 8 occur in the pelvic region attached to the anus and the penis; 2 in each of the sides; 6 in the back; 6 in the cavity of the abdomen (*udara*); 10 in the region of the chest. There are 41 situated in the region above the clavicles. Of these 14 occur in the neck; 4 in the two ears; 9 in the tongue; 6 in the nose and 8 in the two eyes. This amounts to 175 *sirās* carrying *vāta*. The same holds good also of *pitta*, *kapha*, and *rakta* carrying *sirās* with the exception that in these three cases 10 occur in the eyes and 2 in the ears instead of 8 and 4 respectively (Susruta III. 7. 5-7). Diagrammatically the *sirās* and their distribution may be represented as on page 26.

With regard to *pitta*, *kapha* and *rakta* carrying vessels, instead of 4 and 8 in the ears and eyes, 2 and 10 occur in these places respectively.

Besides the *dhamanis* and the *sirās*, Susruta mentions also *srotas*, whose number is given as 22. These ducts emanate from the cavity of the heart and are found to course through the whole body. They are the channels for conveying the life (breaths), food, water, *rasa*, blood, muscles, fat, urine, stools, semen, and catamenial blood (Susruta, III. 9. 11-12).

"The standing puzzle of Indian anatomy and physiology is the classification of *sirās*, *dhamanis* and *srotas*, the channels, passages and ducts in the body, including the arteries, veins, nerves, lymphatic vessels" writes B. Seal.¹¹ The difficulty was felt by the ancient medical writers themselves. All subsequent attempts at clearing up this puzzle have resulted in greater confusion. The chief difficulty lies in the fact that every writer on the subject approaches the problem with preconceived ideas and tries to read his own views into the ancient texts, which invariably leads to confusion. Thus G. Sen would like to have *sirās* as veins, *dhamanis* as arteries and *nāḍīs* as nerves. B. Seal is convinced that *sirās* are arteries and *dhamanis* may stand for veins as well as nerves. K. L. Bishagratna translates *dhamanis* as arteries, nerves and ducts and *sirās* as blood-vessels in general. But nobody except Dasgupta has approached the problem from the historical and evolutionary aspect. *Sirā*, *dhamani*, *nāḍī* and *srota* are words which have a historical background. The words *sirā* and *dhamani*, along with *hirā* and *nāḍī*, occur frequently in the Atharva-veda. Thus in A.V. 1. 17. 3 "Thou *sirā* of the lower part, remain, thou of the upper part, remain, so thou of the middle part, so thou small, so thou big, *dhamani*." With regard to this verse, Bolling remarks: "The apparent distinction between veins and arteries in 1. 17. 3 is off-set by the occurrence of the same words

in vii. 35. 2 with the more general sense of 'internal canals' meaning entrails, vagina, etc. showing how vague were the ideas held with regard to such objects." "But this is not correct," writes Dasgupta, "for there is nothing in 1. 17. 3 which suggests a knowledge of the distinction between veins and arteries in the modern sense of the terms was known at that time. The division of *dhamanis*, *sirās* and *snāvas* seems to have been based on their relative fineness; the thicker channels (*nādīs*) were called *dhamanis*, the finer ones were called *sirās* and the still finer ones *snāvas*. Their general functions were considered more or less the same, though these probably differed according to the place in the body where they were situated and the organs with which they were associated."¹² In Charaka there was not much advance towards a proper understanding of the significance of their distinction and functions. Charaka plainly regards *dhamanis*, *sirās* and *srotas* as ducts having the same functions but differing only in their size, the *dhamanis* being larger than the *sirās*. Susruta refers to Charaka's view that *sirās*, *srotas* and *dhamanis* are the same, opposes it and asserts that they are different in appearance, number and functions. It is on account of their close proximity, similar functions, fineness, and also because of the fact that they have been referred to in similar terms by older authorities, that they have sometimes been regarded as performing the same work, though their functions are really different (S.S. III. 9. 2). With regard to appearance — the *vāta*-carrying vessels are tawny or light golden brown in colour, while the *pitta*-carrying vessels are all warm and of blue colour; the *kapha*-carrying vessels are cool and of white colour, the *rakta*-carrying vessels are of red colour and are neither warm nor cold. As regards number, the principal *dhamanis* are 24, the *sirās* 700 and *srotas* 22. Susruta assigns different functions to *sirās* and *dhamanis*. "*Sirās* by their contractibility and expansibility, etc., sustain and nourish the organism in the same manner as streamlets and canals serve to keep a field or a garden moist and fruitful." (S.S. III. 7. 2). "Contractibility and expansibility" are the recognised attributes of arteries. But in the chapters on the Section on Veins, Susruta consistently uses the term *sirās*, thereby giving us a clue that by *sirās* he meant veins. In describing the *sirās* he mentions they are yellowish red, blue, white and red in colour.¹³ He further mentions the *sirās* as conveying *vāta*, *pitta*, *kapha* and blood. Certainly there is some confusion here. The blue vessels only can be the veins. The other three categories must mean something else. The functions of the *dhamanis* also differ. "The upcoursing *dhamanis* perform such

specific functions of the body as sound, touch, taste, sight, smell, inspiration, sighing, yawning, sneezing, laughter, speech, weeping, etc., and tend to maintain the integrity of the body. The down-coursing *dhamanis* form the channels for the downward conveyance of *vāyu*, urine, stool, semen, and catamenial fluids." (S.S. III. 9. 4 and 6). From the above enumeration of their functions it is clear that *dhamanis* stand for nerves and ducts. On a critical comparison of the detailed list of *sirās* and *dhamanis* it will be noticed that no ducts, no specific nerves except the *vāta* vessels, and no *rasa*-carrying vessels are mentioned in the list of the *sirās*. It is significant that the conveyance of *rasa* is confined to the *dhamanis* only. *Rasa* is the end product of digestion of food. It is converted into *rakta* in the liver and spleen but its great receptacle is the heart. The "arterial" blood of the Indian physiologists is the blood that leaves the liver and the spleen.

"The identification of the *vāta*, *pitta*, *kapha* and *rakta-vāha sirās* with the nervous, venous, lymphatic and arterial systems is not far-fetched and fanciful" says C. Chakraborty.¹⁴

From the above discussion the following conclusions can be deduced :

(1) The heart with all the "vessels" and "ducts" arising or supposed to arise from it constitutes the vascular system. This vascular system was divided into "the blood" vascular and "lymph" vascular and the nervous systems.

(2) The differentiation of the blood vascular system into rigid "venous" and "arterial" systems was not achieved.

(3) The contention that *sirās* and *dhamanis* were used to denote particular types of vessels like veins, arteries or nerves exclusively is untenable. These terms were used indiscriminately to denote the various ducts of the body.

(4) Though a distinction was made between two kinds of blood, the red and the blue, the distinction between arteries and veins in the modern sense of the terms was not achieved.

(5) *Dhamanis* indicated those ducts which have thick walls and *sirās* those having thin walls. This use too was not invariable.

(6) Nerves were classed as ducts and included in the category of *sirās* and *dhamanis*.

NEUROLOGY

Very little is said about the brain in Indian medical literature. It was differentiated from the head even in the Atharva-veda. Thus in X. 28 "which was that God who (produced) his brain, his forehead, his hind head, who first (produced) his skull, who

having gathered or gathering in man's jaws, ascended to heaven." Charaka in I. 11-47 mentions head, heart, arms, etc., as the vital parts. Again in I. 17. 11 he says "that part of the body in which the life breaths are said to inhere, to which all the senses are said to belong, and which is said to be the most important of all the limbs of the body, is called by the name of head." Bhela also recognised the brain and considered it the centre of the *manas*. Susruta does not state anything of importance concerning the brain. He quotes the opinion of Saunaka, that the head is the centre of the senses (S.S. III. 3. 18). He was aware of the existence of at least four pairs of cranial nerves. Thus he says in III. 6. 66-75, that there are four *dhamanis* on the two sides of the *kanṭhanadi*. One *nīla* and one *manya* are situated on either side of the larynx. Injury to any of them produces dumbness or change of voice (hoarseness) and also the loss of the faculty of taste; there are two nerves (*sirās*) lower down the ears on their back called *vidhurā* which, if cut, would produce deafness; on both sides of the nasal aperture, inside the nasal organ, there are two nerves called *phana* which if cut would destroy the sensation of smell; at the back of the eyebrows, below the eyes, there are the nerves called the *apānga*, which if cut, would produce blindness. All the cognitive nerves meet in passing, at the centre of the brow. He further says that the nerves are attached to the brain inside the skull on the upper part of it and this place, called the *romāvarta* is the supreme superintendent (*adhipati*) (S.S. III. 6. 78. 80). Describing the four *dhamanis* which go crosswise and their ramifications in the skin, he says, "it is again these which carry pleasurable and painful sense impressions," (S.S. III. 9. 8). Susruta and Charaka considered the heart to be the only seat of consciousness and this accounts for the inclusion of the nervous system in the vascular system.

SPLANCHNOLOGY

The Atharva-veda mentions the heart, lungs, gall-bladder, kidneys, liver, spleen, stomach, and smaller intestine, rectum and the portion above it, large intestines, abdomen, colon, umbilicus, marrow and placenta. Charaka uses the word *kloma* for the lungs and in the singular. Susruta in addition uses the word *pupphusa*, also in the singular. He asserts the *kloma* along with the liver to be on the right side and the *pupphusa* along with the spleen on the left. It may be that he uses two different terms for the same organ, since the right lung differs from the

left in size and number of lobes. Thus the Atharva-veda, Charaka and Susruta all use the word in the singular. Of the internal organs, Charaka and Susruta were well acquainted with the stomach and intestines. The stomach (*āmāsaya*) is described as being situated above the receptacle of the *pitta*. Susruta mentions the perforated anterior part of the stomach. But no description of the interior is found. Charaka divides the interior into 3 compartments but says this division is purely imaginary. The intestine (*pakvāsaya*) was divided into the small (*kshudrāntaram*) and large intestines (*stulāntaram*). The lower end of the large intestines was called the *gudam* (rectum) and ends in the *gudoushtha*, the anus. Susruta gives the following description of the rectum. "The lower end of the large intestines, which passes into the flexure of the rectum, and measures four and half fingers in length is called the *gudam*, its interior is provided with three spiral grooves. These grooves or ring-like muscles lie a finger and a half apart from one another and are respectively known as *pravāhini*, *visarjani*, and *samvarani* or the grooves of outflow, defecation and closure of the anus, covering a space of four fingers and having laterally an elevation of one finger's breadth." (S.S. II. 2. 4).

The intestines of the adult male measure 14 cubits ($3\frac{1}{2}$ *vyāmas*) in length, while those of an adult female measure only 12 cubits (S.S. III. 5. 8). Susruta gives a description of the bladder. This is situated in the pelvic cavity, surrounded on its different sides by the back, loin, umbilicus, scrotum, rectum, groins and penis. It is provided with a single aperture or opening and lies with its mouth downward, covered with nets of *sirās* and *snāyus*, in the shape of a gourd. It is extremely thin in structure and, thus situated within the pelvic cavity, is connected through its mouth or external orifice with the rectum, the penis, and the testes. The urinary ducts pass close by the large intestines and constantly replenish the bladder and keep it moist with that waste product of the system in the same manner as rivers carry their contributions of water into the ocean. These passages or ducts (which are two) are found to take their origin from hundreds of branches which are not visible to the naked eyes on account of their extremely attenuated structures and, whether in a state of sleep or waking, carry the urine from below the region of the stomach into the bladder, keeping it flooded with this important fluid (S.S. II. 3. 14). In children the bladder is of diminished size and poor in muscular structure (S.S. II. 3. 10). With regard to the uterus (*garbhāsaya*) he says it is situated in the space bounded by the *pittāsaya* and *pakvāsaya*

and is adjacent to the urinary bladder (S.S. III. 5. 43). The vagina of a woman resembles the navel of a conchshell in shape and possesses three involuted turns (*avarthas*) like the interior of a mollusc. The uterus is situated at the third posterior involuted turn. The shape of the uterus resembles the mouth of a Rohit fish (S.S. III. 5. 47). The *vas deferens* is described. The semen passes through the ducts situated about two fingers breadth on either side and just below the neck of the bladder and finally flows out through the canal. (S.S. III. 4. 22 & 23). Two kinds of bone marrow are differentiated. Fat exists in the abdomen of all creatures and also occurs in the small and large bones as marrow (*majja*). In the large bones, particularly in the cavity of which it is found, it is called marrow; in all other bones it is called bloody fat (*raktāni meda*). (S.S. III. 4. 12 & 13).

It is abundantly clear that the Indian medical writers had distinct ideas of the structure of the human body based on a systematic study of the same. They were the pioneers in human dissection. They had also a correct appreciation of the relation of anatomy to the science of medicine. By knowing the anatomy of the body, one attains to a knowledge of all those things which are beneficial to it. For this reason, physicians possessed of skill applaud knowledge of anatomy. (C.S. IV. 6. 2 & 3). Only he who has observed the internal mechanism of the human body and is well read in the works bearing on this subject and has thus all doubt expelled from his mind is qualified in the science of Āyurveda and has a rightful claim to practise the art of healing (S.S. III. 5. 57). As is to be expected, the knowledge of anatomy was imperfect. Nowhere is this imperfection more apparent than in the study of the viscera. Vital organs such as the heart, lungs, liver and brain are only mentioned to be passed over. They seem to have resisted the natural curiosity to expose these organs and investigate their interior. This deplorable apathy and negligence is to be attributed to their peculiar methods of dissection. No amount of soaking in water will force the skull or the heart to disclose its inner structure. The brush is a poor substitute for the scalpel in dissection. "Indian anatomy is no description but merely an enumeration and classification" remarks Neuburger.¹⁵ This criticism is just insofar as their knowledge of pure anatomy is concerned. Description in the modern sense is wanting, but they tried to describe things by comparison with other familiar things. For example, the whole classification of the joints is based on resemblances to familiar objects which need no description. The sacrum is described as the "triangular"

bone *trika*; the hollow bones are *nalika* — reed-like; the cranial bones *kapāla* — pan-shaped; the heart is described as resembling a lotus bud, and so on. Indian anatomy owes its development to the school of Susruta, i.e. the school of surgery, and was therefore ancillary to surgery by whose needs its development was dictated. Fractures and dislocations called for a study of bones and joints. The genito-urinary tract was studied in connection with obstetrics and removal of stones from the bladder. The frequent use of enemata in therapeutics led to a remarkably accurate knowledge of the rectum. Angiology demanded the careful study of all surgeons. Surgical operations demanded a knowledge of regional anatomy rather than elaborate and often unnecessary and tedious descriptions of all the structures of the body. The place of regional anatomy was supplied by the concept of the *marmas*. "*Marma* should be understood as a junction or meeting place of the five organic principles of ligaments, veins, muscles, bones and joints." There are 107 *marmas* in the human organism. Every one of these 107 *marmas* is described in detail—its situation, composition and surgical importance. The medical authorities have described the *marmas* as covering half the scope of *salya-tantra* (surgery) inasmuch as a person hurt in any of the *marmas* dies presently (S.S. III. 6. 83). "Men, versed in the science of surgery, have laid down the rule that in case of a surgical operation, the situation and dimension of each local *marma* should be first taken into account and the incision should be made in such a way as not to affect that particular *marma*, inasmuch as an incision even extending to or affecting in the least the edge or side of the *marma* may prove fatal." (S.S. III. 6. 81). It was the mastery of a knowledge of these *marmas* that contributed to the phenomenal excellence of Indian surgery in spite of their knowledge of anatomy being none too accurate or profound.

CHAPTER II

PHYSIOLOGY

The views of Indian medical writers on physiology have not been carefully studied, owing to the mistaken notion that it consists merely of the physiology of *vāyu*, *pitta* and *kapha*, the *tri-dhātus*. The role of these in physiology is often exaggerated. In fact it is not as important as in pathology. The above three function as any other *dhātus* and are governed by the same laws. A careful study of the Indian medical classics reveals a vast amount of knowledge on problems of physiology. References to it are scattered throughout these works and have to be collated carefully in order to obtain a definite idea of the views contained therein. An attempt is made in this chapter to present in a connected way the ideas of Indian medical writers on some of the important problems of physiology such as food, digestion, metabolism, excretion, blood circulation and the nervous system devoid as far as possible of all *tri-dhātu* phraseology. Much of their knowledge is of course rudimentary but in some cases it is very profound and remarkably correct in its broadest outlines, as in the case of their views on digestion, metabolism, excretion and blood. Due allowance should be made in a study like this for the fact that we are dealing with physiology in its very infancy. The importance of this study is enhanced by a comparison with the views on physiology held by other nations, particularly the Greeks, belonging to the same epoch as the Indian medical writers—probably the 6th century B.C. Meagre as this knowledge is, it forms an important contribution to our knowledge of the evolution of physiological ideas.

THE BODY AND ITS COMPOSITION : The Indian medical writers consider the body a conglomeration (*samudāya*) of the modifications of the five elements (*bhūtas*), earth (*prithvi*), water (*ap*), fire (*tejas*), air (*vāyu*), and ether (*ākāśa*). The modifications of the five *bhūtas* or elements which co-operate together to uphold the body are called *dhātus* and are seven in number, viz. *rasa*, *rakta* (blood), *māmsa* (flesh), *medas* (fat), *asthi* (bone), *majjā* (marrow), and *sukra* (semen). *Vāyu*, *pitta* and *kapha* are also considered *dhātus* under certain conditions. The body

functions properly so long as these *dhātus* are in proper proportions (*sama-yoga-vāhin*) in it. Even in healthy persons their proportions are constantly undergoing fluctuations. Their normal measure (*prakṛita-māna*) covers that amount of excess or deficiency which does not produce trouble or disorder of the body. When they are in their normal measure they are said to be in equilibrium and this condition is called *dhātu-sāmya*. When their normal measure is either increased or decreased, then their equilibrium is upset and this condition is called *dhātu-vaiṣāmya*. The daily regimen of a healthy person ought to be such that the equilibrium of the *dhātus* may be properly maintained. The sole aim of Āyurveda is to prescribe diet, medicines, and a regimen of life, such that, if they are properly followed, a normally healthy person may maintain the equilibrium of his *dhātus* and one who has lost this equilibrium may regain it, that is to advise men how to preserve or secure *dhātu-sāmya*. (C.S. IV. 6. 4-9 ; C.S. I. 1-52 ; C.S. I. 16. 31-34).

FOOD AND ITS FUNCTIONS : Food is the very life of all living creatures. The whole world (of living creatures) pursues food, which is essential for all living creatures and subserves many important functions in the body. Its chief function is to nourish the various *dhātus* which uphold the integrity of the body. The diverse kinds of food beneficial to a living creature, taken seasonably, on being properly digested by their respective fires, whose strength is excited by the internal fire, maintain the growth, strength, complexion, happiness and prolongation of existence of a healthy body, in which a development into all the upholding ingredients is ceaselessly going on. (C.S. I. 28-2). As will be shown later in this study, food is converted into *rasa*, and this in turn into blood, flesh, fat, bone, marrow and semen. Food not only nourishes and strengthens the upholding ingredients of the body but also helps to maintain the equilibrium of the *dhātus*. For maintaining the harmony of even the harmonious *dhātus* of one who is healthy, food is essential. In the living body the *dhātus* are constantly subjected to over-growth and decay or attenuation. Their proportion is influenced by the food one takes, for the different constituents of the body increase or grow when food having similar constituents is taken and attenuate or decay when food having opposite qualities is taken. If a normally healthy man wishes to keep his health at its normal level, he has to take food in various forms, possessing various tastes and attributes, so that no one *dhātu* may come to be in excess or deficit in proportion to any other. Otherwise the equilibrium is bound to be upset. (C.S. IV. 6. 8-10). A third function

which food subserves is that it acts as fuel to the digestive fire, replenishing it and making it function properly. The period of life, complexion, strength, health, exertion, growth, lustre, *ojas*, energy, animal and other kinds of heat and life-breaths have all been said to have the digestive fire as their cause. When this fire is extinguished a person dies. When it burns brightly within the body, one lives long without ailments of any kind; when it is vitiated, one becomes afflicted with disease. Hence one should heedfully maintain that fire with the fuel of well combined and beneficial food and drink. With food as fuel this fire blazes up. Without it, it dies out. (C.S. I. 27, 34; C.S. VI. 15. 1-2).

FOOD, ITS COMPOSITION AND QUALITIES : As already remarked, food subserves many vital functions in the body. It nourishes the *dhātus*, maintains their equilibrium and sustains the digestive fire. The integrity of the body depends upon the nature of the food taken. So a knowledge of the composition and qualities of the various kinds of food is of very great importance. One should never take any food from motives of desire only or in ignorance. Only food that is beneficial should be eaten and that after proper examination. Indeed, the body is the product of the food taken. (C.S. I. 28, 47-48). Charaka and Susruta devote many chapters of their *samhitas* to a critical study of the various kinds of things available as food, discussing in great detail their merits and demerits. The body of a living being is composed of the five fundamental elements (*bhūtas*) and the food of a living organic being necessarily partakes of the character of its corporal components. All materials used as food are also compounded of the five elements (*bhūtas*) earth, water, fire, air and ether, and from the predominance of one or the other of these are called earthy (*pārthiva*), watery (*āpya*), fiery (*āgneya*), airy (*vāyavya*), ethereal (*ākāśātmaka*). Those parts of the body which are specially bulky, motionless, solid, heavy, rough and hard — such as the nails, bones, teeth, muscles, skin, etc., are *pārthiva* (earthy); smell and the sense of smell also are earthy. Those parts which are liquid, inactive, viscid, soft, slimy and which flow, such as the *rasa*, blood, fat, lymph, *kapha*, *pitta*, urine, sweat etc., are *āpya* (watery); taste and the sense of taste also are watery. The heat of *pitta* and the radiance of the body are *āgneya* (fiery); colour and the sense of sight also are fiery. Exhalation, inhalation, the opening and closing of the eye-lids, contraction, expansion, movement, incitement, sustenance, etc., are *vāyavya* (airy); touch and the sense of touch also are airy. The pores and the channels of the body are *ākāśātmaka* (ethereal); sound and the sense of hearing also are

ethereal. (C.S. IV. 7. 17-22). The *pārthiva* ingredients of the food are utilised for nourishing the *pārthiva* parts of the body — the muscles, bones and other solid parts; the *āpya* ingredients nourish the *āpya* parts. And so with the others. (C.S. VI. 15. 10-12).

Foods are not merely compounds of the five *bhūtas*. They possess in addition various qualities (*gunās*) which play an important role in the physiology of digestion and metabolism. Of these qualities one of the most important is taste or *rasa*. Some authorities maintain that the nutritive power of the food of the living being depends on the *rasas* and it is thus that food maintains life (S.S. 40.4). The theory of *rasas* or tastes plays an important part in Āyurveda in the selection of medicines and diet. A detailed discussion of it is given in Chapter VI; here we can state only the importance of *rasas* and the part they play in the metabolism of the body. The tastes are six in number — sweet, sour, saline, pungent, bitter and astringent. All the five elements are present in all the *rasas*; but in different *rasas* different elements predominate, and the *rasas* are differentiated accordingly. Thus with predominance of *soma* there is a sweet taste; with the predominance of earth and fire an acid taste; with water and fire a saline taste; with air and fire, a hot and pungent taste; with air and *ākāśa*, a bitter taste; with air and earth, an astringent taste. Each of these tastes was considered as being capable of producing certain good or bad physiological effects. Thus the sweet (*madhura*) taste is said to increase blood, flesh, fat, marrow, semen and life, to benefit the six senses and to produce moistening, cold, heaviness, etc. The acid (*amla*) is said to rouse digestion, develop the body, and remove *vāta*; it is light, warm, moist, etc. The saline (*lavana*) taste is digestive; it removes *vāta*, secretes *kapha* and is moist, warm, etc. The pungent (*kaṣṭu*) taste provokes digestive fire. It is light, warm, dry, etc. The bitter (*tikta*) taste promotes or sharpens the appetite. It assists the digestion of the undigested food. It removes bad humours, etc. It is dry, cool, and light. The astringent (*kaṣāya*) taste restores harmony among the faults; it is dry, cool and heavy, etc. It was supposed that the taste (*rasa*) of some substances changed altogether after digestion and that in such cases the taste into which it changed after digestion (*pāka*) would be operative. The six tastes separately or in admixture, taken or administered properly and in due measure, nourish the body. (C.S. I. 26. 53-69).

In addition to taste, substances were considered to possess other qualities (*gunās*). Charaka mentions ten pairs of these;

heavy and light ; cold and hot ; oily and dry ; mild and keen ; compact and mobile ; soft and hard ; clean and slimy ; smooth and rough ; minute and gross ; solid and liquid. Of these, great stress was laid on the properties of heavy and light. (C.S. IV. 6. 11-12). It must be admitted that this distinction is not without reason. Foods called "light" contain largely the properties of wind and heat, while those called "heavy" contain largely the properties of earth and *soma*. For this reason, all kinds of light food are, in consequence of their natural properties, endowed with the capacity of enhancing the digestive fire and are said to be less injurious even when taken to satiety. All kinds of heavy food, on the other hand, in consequence of their dissimilarity, are incapable of prompting the digestive fire. Hence they become injurious when taken to the point of gratification (of hunger). (C.S. I. 5. 3). Each taste (*rasa*) is listed as heavy or light. In heaviness the sweet taste comes first, the astringent is middling and the bitter comes last. In lightness the bitter taste comes first, the pungent is middling and the sour comes last. (C.S. I. 26. 11-12). Finally a reference must be made to what is described in medical literature as the energy (*vīrya*) of a substance, that is to say, the quality in virtue of which the substance acts or operates on the system. Some say that mild and keen, heavy and light, oily and dry, heating and cooling are the eight kinds of energy which objects may have. Others are of opinion that objects have only two kinds of energy, cooling and heating. (C.S. I. 26. 20-21). If an article contains an excess of the element of fire, it has the hot and vehement energies. When the watery element predominates the cold and lubricating energies are found. In earthy and watery objects the oily energy exists. Objects with excess of ether and water have the softening energy. Air causes the drying energy and when earth and air predominate they produce the clearing energy. With regard to heating and cooling properties, the tastes fall into two groups : the sweet, bitter and astringent tastes are said to be cool and the acrid, acid and saline tastes to be hot. (S.S. I. 42).

The principle of nourishment is involved in the maxim that "through the union with something of similar attributes, all the attributes of the constituent elements (of the body) gain in strength, while through union with things of dissimilar attributes, they become attenuated." Hence, above all other constituent elements of the body, flesh is nourished by flesh. Similarly blood is nourished by blood, fat by fat, bones by cartilages, marrow by marrow ; semen by semen and a foetus by eggs. Where, however, such types of food and drink as are possessed of similar

attributes are not obtainable, or, being obtainable, are not suitable in consequence of unassimilability, or of an aversion felt for them, or for any other reason, and where it is necessary to nourish the particular ingredients of the body, one should, in view of the impossibility of administering such types of food and drink as are possessed of similar attributes, administer such substances of other nature as happen to be possessed in a great measure, of similar attributes, e.g., the seminal fluid may be increased by taking milk and butter. (C.S. IV. 6-12-15).

DIGESTION : Indian medical writers describe food as of four kinds : *asita* or solid food, *pīta* or liquids, *līdha* or food taken by licking, and *khādita* or food that is chewed. If taken in the right measure, food and drink lead to the improvement of the several ingredients of the body and of strength and complexion, and contribute to the sense of well-being. If taken otherwise they are injurious (C.S. I. 28. 2). The amount of food one requires is dependent upon one's digestive power. That should be the standard, being the amount which can be digested in due time without injuring one's constitution (C.S. I. 5. 2). Unless the food is properly digested it cannot nourish the body, because undigested food is useless. The digestion of food is effected by heat which digests, air which collects together all that is necessary for the action of heat, water which softens, fat which makes the food smooth and time which helps the process of digestion ; and out of these heat — digestive fire — is the most important (C.S. IV. 6-19-20). It is due to fire that food nourishes the body, the *dhātus*, the *ojas*, the strength, the complexion, etc., writes Charaka (C.S. VI. 15. 4). The four varieties of food derived from the five elements and having the six tastes, the two properties of heat and cold and many qualities, when taken in the quantity directed and thoroughly digested produce a fine substance imbued with energy and fire. (C.S. I. 14.3). This substance, which is in the form of a juice, is called *āhāra-prasāda*, food substance and *rasa*. The essence of the process of digestion is the production of this *rasa*. Charaka thus describes the process of digestion. It is the life-breath called *prāṇa* that seizes the food and sends it down to the stomach. When there, the solidity of what is thus taken in is dissolved by liquid juices. It is then softened by the oily matter. Then in time the fire, stirred up by the life-breath called *samāna*, blazes forth and digests the food that has been taken equally and properly. The digestive fire below cooks the food in the stomach, converting it into *rasa* and *mala* even as (external) fire and water cook grains of rice in a vessel for use as food. At the commencement of the

process of digestion, the six *rasas* (contained in the food) begin to be digested. Due to the digestion, a sweet reaction sets in and due to this sweet condition a foamy *kapha* is next produced. A little while later, when the food is only half digested, a sour reaction sets in. The food in this state passes out of the *āmāsaya* into the *pakvāsaya*. Then springs from it a liquid substance called *pitta*. When at last the digested food comes into the intestines, it begins to be dried up by the fire and is converted into a compact mass. During the process a bitter and astringent reaction sets in, due to which *vāta* is generated. (C.S. VI. 15. 5-10).

Indian medical authorities mention two sorts of digestion, sweet and acrid; of these the sweet is heavy and acrid is light. Earth, water, fire, air, and ether may be divided into two classes according to their properties into light or heavy, earth and water are heavy and the other three are light. When, during the digestion of material objects, the properties of earth and water exist in large proportion, the result of the digestion is sweet but when fire, air and ether predominate the result is acrid digestion (S.S. I. 40. 10).

METABOLISM : When food is fully digested by means of the digestive fire, it gives rise to *rasa*. The Indian medical writers draw a distinction between this *rasa* and the *rasa* which forms one of the body-constituents (*dhātus*). The former is called *āhāra-rasa* and the latter *rasa-dhātu*. From the *pakvāsaya*, *āhāra-rasa* is driven by *prāna-vāyu* along *dhamani* trunks first to the heart. From the heart it flows through the *dhamanis* which arise from it to the remotest parts and extremities of the body. Flowing out from the heart, it constantly satiates, increases, nourishes and supports the body and keeps it alive by some unseen cause or destiny (S.S. I. 11. 4. 3). *Rasa-dhātu* is produced from the *āhāra-rasa*, blood from *rasa-dhātu*, flesh from blood, fat from flesh, bones from fat, marrow from bones and finally semen from marrow (S.S. I. 14-10). To these seven commonly recognised *dhātus* Charaka and others add an eighth, *ojas*, which is produced from the semen (C.S. I. 28. 14). According to Susruta, all the *dhātus* contribute to the production of *ojas*. The *rasa-dhātu* is successively transformed into each of the six remaining body-constituents (*dhātus*) and according to Susruta it continues in the shape of each *dhātu* for a period of 3,015 *kālas* or roughly five days. Thus it is converted into semen in the course of a month (S.S. I. 14-14). But Charaka maintains, "this transformation of food and the *dhātus* goes on eternally like the motion of a wheel." (C.S. VI. 15-20).

This transformation of the *āhāra-rasa* into the several *dhātus* is brought about by a process of cooking (*pāka*) for which five *bhūtāgnis* and the seven *dhātuvāgnis* are responsible. The food, consisting of the five elements (*bhūtās*), is first digested by the internal heat (the digestive fire) and subsequently by the five elemental heats or fires (*bhūtāgni*) in turn and each of its constituent elements goes to augment its own allied element (*bhūta*) in the body (S.S. I. 46. 524). The *dhātus*—*rasa*, *rakta*, *māmsa*, *medas*, *asthi*, *majjā* and *sukra*—are cooked by their respective fires. Chakrapāṇi, the commentator of both Charaka and Susruta, gives further details of this process of cooking (*pāka*) of the *dhātus*. As a result of it each *dhātu* is supposed to give off a finer essence (*sūkṣmabhāga*) which serves as the material of the next succeeding *dhātu* and a dross (*mala*) which forms the source of the excreta in the body (including the nails, the hairs, etc.) besides retaining its own substance (the gross or the main part) which is driven by the *vāyus* or the *srotas* to its destination in the body.

The successive transformation of the body-constituents takes place in a definite order. B. Seal thus summarises this process. "The essence of *Rasa* (*Sūkṣmabhāga*) from the small intestines is driven by the *prāṇa-vāyu* along a main trunk first to the heart (which is a great receptacle of *Rasa*), and thence to the liver and spleen; and in the liver the colouring substance in the bile acts on the essence of *Rasa*, especially on the *tejas*-substance therein and imparts to it a red pigment transforming it into blood; but the grosser part of *Rasa* (*Sthūlabhāga*) proceeds along the *dhamanī*, driven by the *vyāṇavāyu* all over the body. When the blood has been formed, the essence of *Rasa* in the blood, acted on by *vāyu* and *māmsāgni* (the flesh-forming fire) forms the flesh tissue, the earthy part of the food substance specially contributing to this tissue. Of the flesh tissue thus formed, the grosser part goes to feed or replenish the flesh tissue all over the body. The finer essence of flesh in the blood, in the *rasa*; acted on again by *vāyu* and the fat forming fire in the menstrium of lymph (*Rasa*) receives viscosity and whiteness, and produces the fatty tissue, the earthy and watery parts of the food specially contributing to the product. The fat in the *Rasa* (or blood) or rather the grosser part of it replenishes the fatty tissue of the body, but the finer essence of fat in the flesh in the blood, in the *rasa* acted on by *vāyu* and the marrow-forming fire, in the menstrium of lymph (*Rasa*) becomes hard or crystalline, and forms bone; the earthy, airy and the fiery parts of the food contributing principally to the product. The essence of the fat

fills the hollow channels of the bones, and acted on by *vāyu* and marrow-forming fire, becomes transformed into marrow. The marrow is similarly transformed into semen. The semen or rather all the elements in their finer essence, give off *ojas*, which returns to the heart, the receptacle of *rasa* and blood, and again floods the body and sustains the tissues thus completing the wheel (or self-returning circle of metabolism) ".¹ It is to be noted that, throughout, the *rasa* acts as the mother-substance and that each constituent of the body (*dhātu*) takes up the proper elements (*bhūtas*) from the food-*rasa* to form the next body constituent. Throughout, the transformation of the finer essences of the preceding *dhātus* into the succeeding body constituent (*dhātu*) is brought about by its respective *dhātvāgni*.

The above hypothesis regarding the course of metabolism is known as the irrigation channel one (*kedarī-kulyā-nyāya*). Apart from it there are two others. According to one, the whole *rasa* is converted into blood, the blood into flesh, and so on. According to the other, just as in a farm house pigeons of different descriptions sit together (*khale kapota-nyāya*) so not all the digested *rasa* passes through the channel of the *rasa dhātu* but different parts of it pass through different channels at different times from the very first stage, but there is generally a time limitation, the *rasa dhātu* is nourished first, the blood next, and so on, coming finally to the *sukra dhātu*.

In addition to the above mentioned seven principal body-constituents (*dhātus*) there are also many secondary ones (*upa-dhātus*). Charaka gives a list of these and states whence they are produced. From *rasa* is also produced mother's milk and menstrual blood, the thick tissues or ligaments (*kandarā*) and *sirās* and the six layers of skin, and from fat (*medas*) are produced the ligaments (*snāyus*) (C.S. VI. 15. 16). Finally it must be mentioned that the five senses, which according to *Āyurveda*, are compounded of the five *bhūtas*, are also nourished by the *āhāra-rasa*.

DHATUS AND THEIR FUNCTIONS : *Rasa* keeps the individual in good spirits and nourishes the blood. The blood imparts colour to the body, nourishes the muscles and preserves life. The muscles nourish the fat and give plumpness or fullness to the body. The fat produces the oily matter of the body and the perspiration, nourishes the bones and imparts firmness to them. The bones support the system and nourish the marrow. The marrow fills the bones, nourishes the semen and imparts strength, shining appearance, and loveliness to the body. The semen causes strength, endurance, sprightliness and inclination

for sexual intercourse and is the source of the offspring (S.S. I. 15. 1).

LIVER AND SPLEEN : The liver and spleen are always mentioned together in the Indian medical classics. Their functions are taken to be identical. They are the special seats of blood. They are also the seat of the bile called the *ranjaka-agni*. It is this bile which colours the *rasa* red, thus converting it into blood (S.S. I. 21: 16). Charaka mentions the liver and spleen as the root of the ducts that bear the blood (C.S. III. 5-8). Bile was well-known and is described as a pungent fluid with a foetid smell and yellowish blue in colour. Hot bile has an acrid taste and digested bile an acid taste (S.S. I. 21. 17). The part which bile plays in connection with digestion was well recognised by Susruta. He denies the existence of a separate digestive fire from the bile, in opposition to the views of Charaka who maintains the digestive fire to be distinct from the bile. It is the bile called *pāchakāgni* located in the region between the stomach and intestines (*pakvāsaya*) which digests the four kinds of food (S.S. I. 21. 15).

THE WASTE-PRODUCTS OR 'MALAS' : As a result of metabolism two kinds of products are constantly produced in the body—those which pollute the system—the *mala*, and those which sustain and nourish it—the *prasāda*. As mentioned in the sections on digestion and metabolism, *malas* are produced both in the digestion of the food and the metabolism of the *dhātus*. The *malas* of food are faeces and urine. The *mala* of *rasa* is *kapha*, that of blood is *pitta*; that of flesh is the waste in the apertures of the human body, e.g. dirt of the ears, eyes, nostrils, of the pores of the body and the genital organs; of fat is sweat; of bones is hair and nails; of marrow is the waste matter in the eyes and oiliness of the skin (C.S. VI. 15. 17 and 18). It must be noted, however, that the *malas*, so long as they remain in their proper measure, do not pollute or weaken the body or produce diseases. Indeed, so long as they do not exceed their proper measure, far from weakening the body, they may actually serve to sustain it. Under these conditions they are entitled to be called *mala-dhātus*. The theory of the waste products is that, in proper measure, they serve to sustain the body and perform important functions, but when in excess of or below their proper measure they pollute the body and may ultimately destroy it. We have already seen that proper proportion of the *dhātus* constitutes health and that this is maintained only when food possessing proper qualities, etc., is taken in proper measure. Not all the food we take can be absorbed into the

system and as a result waste products are constantly produced in the body. It is, therefore, necessary that there should also be a proper functioning of the causes which go to produce waste products so that only the proper quantity of these is produced and not an excess or deficit.

Of the waste products or *malas* the most important are *vāyu*, *pitta* and *kapha*. They play a very important role in the theory of the production of diseases in Indian medicine. A detailed discussion of them is given in Chapter III. We may just mention another waste product or *mala* which was considered important, that is, urine. Susruta makes some interesting observations with regard to its production. "The urinary ducts constantly replenish the bladder and keep it moist with that waste product of the system in the same manner as rivers carry their contributions of water into the ocean. These ducts are found to take their origin from hundreds of branches which are not visible to the naked eyes on account of their extremely attenuated structure and carry, whether in a state of sleep or waking, the urine from below the region of the stomach into the bladder keeping it filled with this important fluid of the body just as a new pitcher, immersed up to its neck in a vessel full of water is filled by transudation through its lateral pores." (S.S. II. 3-14). As to the function of urine he says: "the urine fills the bladder and removes the impurities of the body." (S.S. I. 15. 16). Eight varieties of urine—those of the sheep, the goat, the cow, the buffalo, the elephant, the camel, the horse and the ass—are referred to, with their tastes and properties (C.S. I. 1. 92-103); but as far as we are aware there is no description of normal urine of man, although the urine in various diseases (*prameha*) is described in detail in C.S. II. 4. 9. 21. The smell, colour, taste, touch (cold or warm), the presence or absence of sediments, and whether the urine solidifies on keeping or not are all indicated.

THE HEART AND ITS FUNCTIONS: We have seen in the chapter on anatomy how rudimentary were the ideas of the Indian medical writers with regard to the structure of the heart; but about its functions they possessed considerable knowledge. The heart is the primary seat of the *rasa*. It receives the blood after its transformation in the liver. It is also the seat of the foremost *ojas*. There resides in the heart a quantity of pure fluid which is slightly yellowish and is called *ojas*. Through its attenuation or loss even death may overtake a man (C.S. I. 17. 74). Thus the heart is the chief receptacle of the three most important fluids of the body—the *rasa*, the *rakta* and the *ojas*. It is the

heart which is responsible for the distribution of these vital fluids to the remotest parts of the body. This function is accomplished through the numerous *sirās*, *dhamanis* and *srotas* that arise from it. Besides, the heart is the one seat of consciousness (C.S. IV. 7-10). The body, consisting of the six limbs, knowledge, the senses and the five objects of the senses, the soul invested with attributes, the mind and thoughts are all supported by the heart, just as a house is supported by pillars and rafters (C.S. I. 30-4). What Charaka means by this is "that the *manas* and the soul reside in the heart and so also cognition, pleasures and pain, not, however, in the sense that the heart is the place where these reside but in the sense that they depend on the heart for their proper functioning; if the heart is wrong, they also go wrong; if the heart is well they also work well. The self which is the cause of all knowledge of sense-objects and the upholder of the system resides in the heart." In the chapter on anatomy we have shown how some of the *dhamanis* that rise from the heart are nerves, some sensory and some motor. It is through impulses conveyed by these nerves that the heart performs its function as a nervous centre. Besides the nerves from the heart there arise all the great *dhamanis*, *sirās* and *srotas*. These *mahāmūlas* produce mighty consequences. We have seen the heart is the seat of the mind. Charaka attributes insanity to the blocking of those "ducts" through which the mind operates (C.S. II. 7-14).

BLOOD, ITS CHARACTER AND FUNCTIONS : Blood is one of the seven *dhātus*. Susruta places it alongside *vāyu*, *pitta* and *kapha*, holding that these three together with a fourth, the principle of blood, determine the origin, preservation and dissolution of animated organism and permeate it with their respective properties till the moment of death (S.S. I. 21. 3). It is derived from the *rasa-dhātu*. It obtains its colour in the liver and spleen by the action of *ranjakāgni* (S.S. I. 14. 4). Blood is neither hot nor cold. It is sweet, unctuous, of red colour, heavy and with a smell of raw meat. Its heating or burning quality is like that of bile (S.S. I. 21. 17). Charaka thus describes the colour of healthy blood. "The blood that happens to be the colour of molten gold or like that of the insect *indragopa* or like that of the gem called *padmaraga* or like that of *gunja* seeds should be known as healthy." When the blood is vitiated by the action of *vāyu*, it becomes very red, frothy, unctuous and thin. If vitiated by *pitta*, it becomes darkish-yellow in colour and warm, so that in consequence of its warmth it takes long to congeal. If vitiated by the action of *kapha*, it becomes slightly pale,

unctuous, fibrous and thick. (C.S. I. 24. 19-21). It is evident from the above statement that "the blood takes long to congeal", that medical writers knew about the coagulability of blood. With regard to the functions of the blood, Susruta holds the view that it is identical with that of *rasa*, to which greater importance is attached by other medical writers. It is curious that Susruta talking about *rasa* and its functions, abruptly switches on to the statement "the strength or the weakness of the *dhātus* depends upon the richness or poverty of the blood." (S.S. I. 14-44). The blood in its normal state and flowing through its specific *sirās*, strengthen the other fundamental principles (*dhātus*) of the body, improves the complexion, aids the organs of touch in the proper performance of their functions and produces other functions characteristic of it in the body. Blood is life. It is blood that maintains vitality. Hence it should be preserved with the greatest care, says Susruta as to the importance of blood (S.S. III. 7-11). "Verily it is pure blood that brings about strength, good complexion, happiness and longevity, for the life of living creatures is dependent on blood." (C.S. I. 24. 3).

CIRCULATION : The reconstruction of the views on circulation held by the Indian medical writers is one of the most difficult problems in Indian physiology. The data necessary for it is in many instances wanting and even where available contains many discrepancies and contradictions. Different views are expressed by the same writer in different parts of his work. Neither is any help available from the ancient commentaries. The commentators are silent over the very things on which their elucidation and comment is needed. The modern writers on this subject, in their anxiety to prove that the ancient Indian writers knew everything about circulation, have read into the ancient texts much more than they warrant. So any reconstruction of the scheme of circulation of the Indian medical writers must be imperfect. Even in the Atharva-veda there is mention of general flow of certain fluids in the body. In A.V. X. 2. 11 we read "who stored in him floods turned in all directions moving diverse and formed to flow in rivers pink, rosy red, and coppery dark running in all ways in man and upwards and downwards." In the preceding sections we have seen that the body is nourished by three important fluids, *rasa*, *rakta* (blood) and *ojas*. All three are definitely mentioned as flowing throughout the body. The term *rasa* is derived from the root *ras* 'to go', and the substance is so called from the fact of its continually flowing (S.S. I. 14. 13). The blood in its normal state and flowing through its specific *sirās* strengthens the other fundamental

principles of the body. (S.S. III. 7-10). The heart is the seat of the foremost *ojas* and the root of ten ducts which bear the *ojas* into every part of the body. (C.S. I. 30. 5). Of these three fluids, the distribution of *rasa* and to a certain extent of the blood is dealt with in detail by Susruta, as he held that "living beings are produced from the *rasa*, and the strength or weakness of the *dhātus* absolutely depends upon the richness or poverty of blood." Blood is produced from *rasa*, flesh from blood, fat from flesh, bones from fat, marrow from bones and finally semen from marrow. *Rasa* produced from food and drink nourishes these constituent parts of the body. Charaka in C.S. V. 15. 15 conforms to the same number and order of *dhātus* as mentioned by Susruta above, but in C.S. I. 28. 4 he adds to this list yet another called *ojas*. "From that juice which springs from food grow the *rasa-dhātu*, blood, flesh, fat, bones, marrow, semen and that which has been called the *ojas*." Thus the *ojas* becomes the eighth *dhātu* and is derived from the semen and this *ojas*, as mentioned in the section on the heart, collects in the heart. On this view, the *rasa* after its transformation into *dhātus* reaches the heart as *ojas* and is thence distributed to every part of the body by the ducts that arise from the heart (C.S. I. 30. 7). Thus the *rasa* performs a circuit and this is the only basis for the view that the Indian medical writers knew of its circulation. But it must be mentioned that Susruta, to whom we owe most of our knowledge of the circulation of *rasa*, does not hold this view. As Dalhaṇa mentions, most of the writers held that there were only seven *dhātus*. The *ojas* was derived not from the semen alone but from all seven. "The essence of all the seven *dhātus*, from *rasa* to semen is called *ojas*. In this sastra, *ojas* should be understood to be synonymous with *bala* or vital power. It is mobile or capable of moving about from one place to another within the organism. The whole body with its limbs and members is permeated with *ojas*." (S.S. I. 15. 14). No special receptacle is mentioned for the *ojas*. Thus the *rasa* proceeding from the heart is utilised in the production and nourishment of the *dhātus*.

With regard to the distribution of the blood there is a good deal of obscurity. In a general way it is the same as that of *rasa*. The *rakta* is produced from the *rasa* and in its turn gives rise to the formation of flesh. In a strict sense it is the *rasa* that is distributed to all the *dhātus* and not the blood. But in the many passages we have quoted in the section on blood, the blood is mentioned as essential to life and its preservation and as permeating the whole organism. The strength or weakness of the

dhātus depends on the richness or poverty of the blood. The life of living creatures is dependent on blood. Thus blood is given the same status as *rasa* and Susruta considers their functions identical. The blood is mainly carried by the *sirās*. Susruta, enumerating the principal *sirās*, mentions ten for the carriage of blood. But with regard to the origin of the *sirās* there is a lot of obscurity. As mentioned in the chapter on anatomy, Susruta makes contradictory statements in this regard. *Rasa* is converted into blood in the liver and spleen. Both Charaka and Susruta mention them as its seat. (S.S. I. 21. 16 ; C.S. III. 5. 8). It is quite natural therefore to suppose that the *sirās* which carry the blood arise from these organs. Charaka indicates the heart as the source of the *sirās*. Writing of the ten ducts arising from the heart, he says, "they are called *sirās* because of the *rasa* journeying through them." (C.S. I. 30. 11). Vāgbhaṭa also mentions the heart as the source of the ten *sirās*. From the above, it would appear that the liver and spleen as well as the heart are the origin of the *sirās*. In support of this contention is the statement of Susruta : "The seats of blood are the liver and spleen whence it helps its other receptacles to serve their proper functions." Here he refers to other receptacles or seats of blood, but nowhere is it explicitly stated that the blood collects in the heart or, if it is found there, how it is conveyed there. Among the *dhamanis* that arise from the heart four are mentioned by Susruta as conveying blood to the upper and lower parts of the body. It is to be inferred from this that the heart contains blood also. The *rasa* is first conveyed to the heart and afterwards to the liver and the spleen where it is converted into blood, and thence the blood is distributed by the vessels arising from it to the various parts of the body. If this is the route followed by the blood then the necessity for its conveyance to the heart is not clear. But as blood is found in the heart it must be assumed that there is a connection between the liver and spleen and the heart for its conveyance.

The next question that arises is whether this blood is "venous" or "arterial". According to the Indian medical writers, blood is of one kind only. In the chapter on anatomy, it was mentioned that two kinds of blood, the red and the blue, were recognised. But what the "blue blood" is, is not clear. The *rasa* is coloured red by bile in the liver. This coloured fluid is called blood. Charaka and Susruta had no idea of the part played by the lungs in the purification of the blood. The *rasa* that has passed through the liver and spleen must be called the "arterial blood" of the Indian system of physiology. The *rasa* not yet converted into

blood may be called "the venous blood" or the blue blood. Curiously enough the colour of the *rasa* is nowhere explicitly stated.

With regard to the part played by the heart in the distribution of the *rasa* and other fluids, the heart is considered a receptacle and not a pump. It is described as a single cavity. Charaka and Susruta had no knowledge of its internal structure, nor did they know that it possessed any contractile power. Susruta's statement, "the heart which is of the shape of a lotus bud, hangs with its apex downwards folding itself up during sleep and expanding with the return of waking consciousness", cannot be construed as implying a knowledge of the systole and diastole of the heart. On the other hand, there are a few statements which imply a contractile power in the vessels—*sirās* and *dhamanis*. Susruta describes the *sirās* as possessing the power of contraction and expansion (S.S. III. 7. 2). Charaka mentions pulsations of the *dhamanis* called the *manya* situated in the neck. (C.S. V. 3. 7). But these movements are independent of the heart. According to Susruta and Charaka the power which brings about the distribution of the various fluids of the body is the *vāyu* called the *vyāna*. The *rasa* is continuously distributed through every part of the body simultaneously by the *vāyu* called *vyāna* whose function it is to distribute. (C.S. VI. 15. 30).

The manner in which the *rasa* and blood are distributed all over the body is made clear by Susruta by means of an analogy. "The *sirās* by their contractibility and expansibility sustain and nourish the organism in the same manner as streamlets and canals serve to keep a field or a garden moist and fruitful." (S.S. III.7.2). This analogy of irrigation channels is a favourite one with the Indian medical writers. The course of metabolism, as was mentioned in that section, was based on the same analogy. The heart is the reservoir which holds the various fluids, just as the tank holds the water meant for irrigation. The various vessels are comparable to the channels which distribute the water all over the field, distributing the various fluids all over the body in the same manner. The tank is replenished by water from a different source and not by the water that flows into the channels. So the heart is also replenished with the various fluids it distributes from different sources—the *rasa* from the *pittāsaya*, the *rakta* from the liver and spleen and the *ojas* from the semen or from all the *dhātus*. There is no return of the original fluids to the heart as the various fluids are utilised by the various *dhātus* of the body for their growth and nutrition.

It is now possible to construct the scheme of "circulation" held by the ancient Indian medical writers. The *rasa* manufactured in the *pittāsaya* is carried by means of *dhamanis* to the heart which is designated as its seat. From the heart it is carried by eight *dhamanis*—two to the upper part of the body, two to the lower part and two each laterally. On its way it is first conveyed to the liver and spleen where a portion of it is converted into blood and the rest is carried to the other *dhātus* for their production and nutrition on the irrigation channel system. The blood is carried from the liver and spleen by ten *sirās* which divide into 175 and distribute it to all parts of the body (The details of this have been mentioned in the chapter on anatomy). Some blood appears to be carried to the heart by the *sirās*, presumably by those that go to the chest. From the heart it is carried by four *dhamanis*, two to the upper part of the body and two to the lower part. It is curious that the lateral coursing *dhamanis* are not mentioned as carrying any blood. There are no special ducts for the carriage of the *ojas*. Charaka mentions it as flowing out of the ten ducts arising from the heart. It must be presumed that it is distributed along with the *rasa* as no mention is made by Charaka of any blood in the heart. Susruta, as stated above, considers the whole body as the seat of the *ojas*.

While the necessity for the distribution of *rasa* to the tissues is evident, the necessity for the distribution of blood to the whole body is not clear. As *ojas* contributes solely to the strength of the *dhātus* it has to be distributed to them. The only explanation that can be offered is that the "circulation of the *rasa*, so far as it was held to contribute its quota to the constituent elements and tissues of the body, was really supposed to be identical with the circulation of the blood." The Indian medical writers seem to have held the view that the various *dhātus* in every part of the body were connected by means of subtle currents, *srotas*, with the same kind of fluid or tissue in every other part. Thus strictly there are as many minor "circulations" as there are *dhātus*.

RESPIRATION: Charaka and Susruta say very little about the lungs and their functions. Beyond the mere mention of their existence there is practically no further reference to them. In his description of phthisis, Charaka makes many valuable observations concerning hemoptysis, aphonia, hoarseness and pains in the flanks but no mention is made of the lungs. Instead of lungs the more general term *uras*, meaning chest, is used. But Charaka in *Vimānasthāna* makes a very interesting statement.

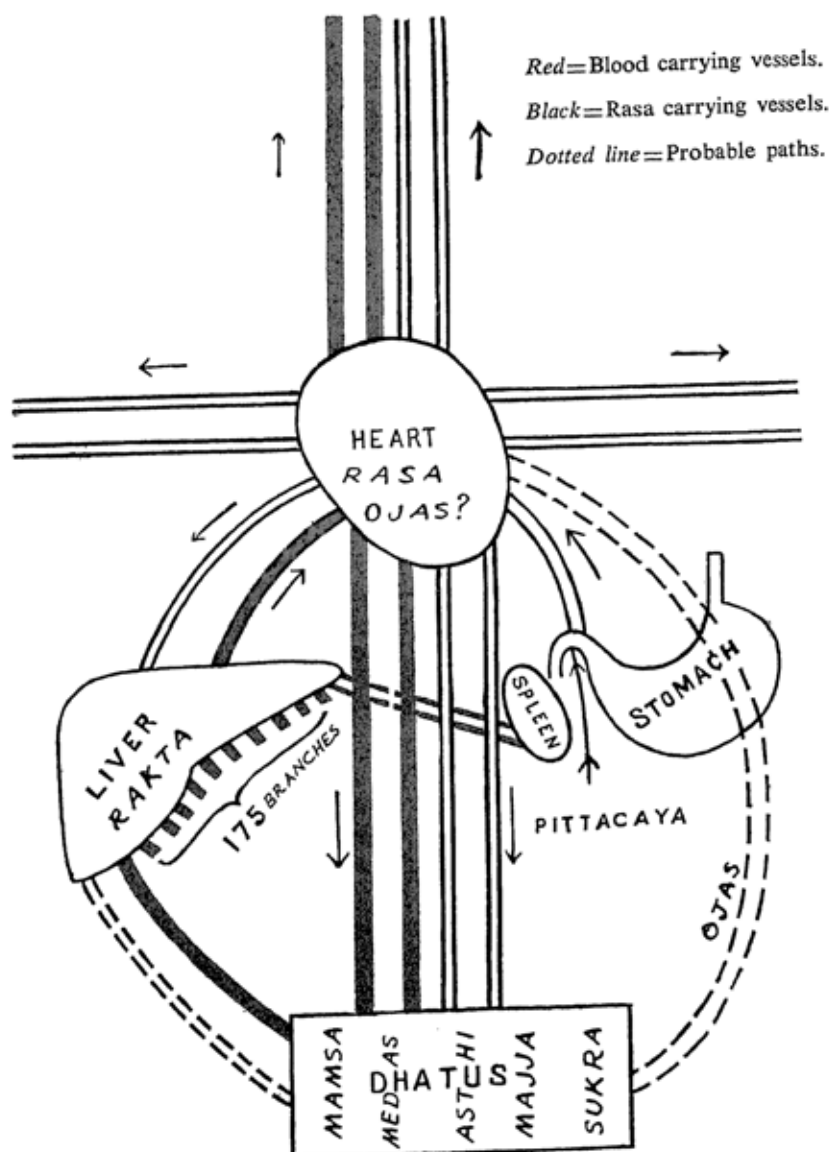
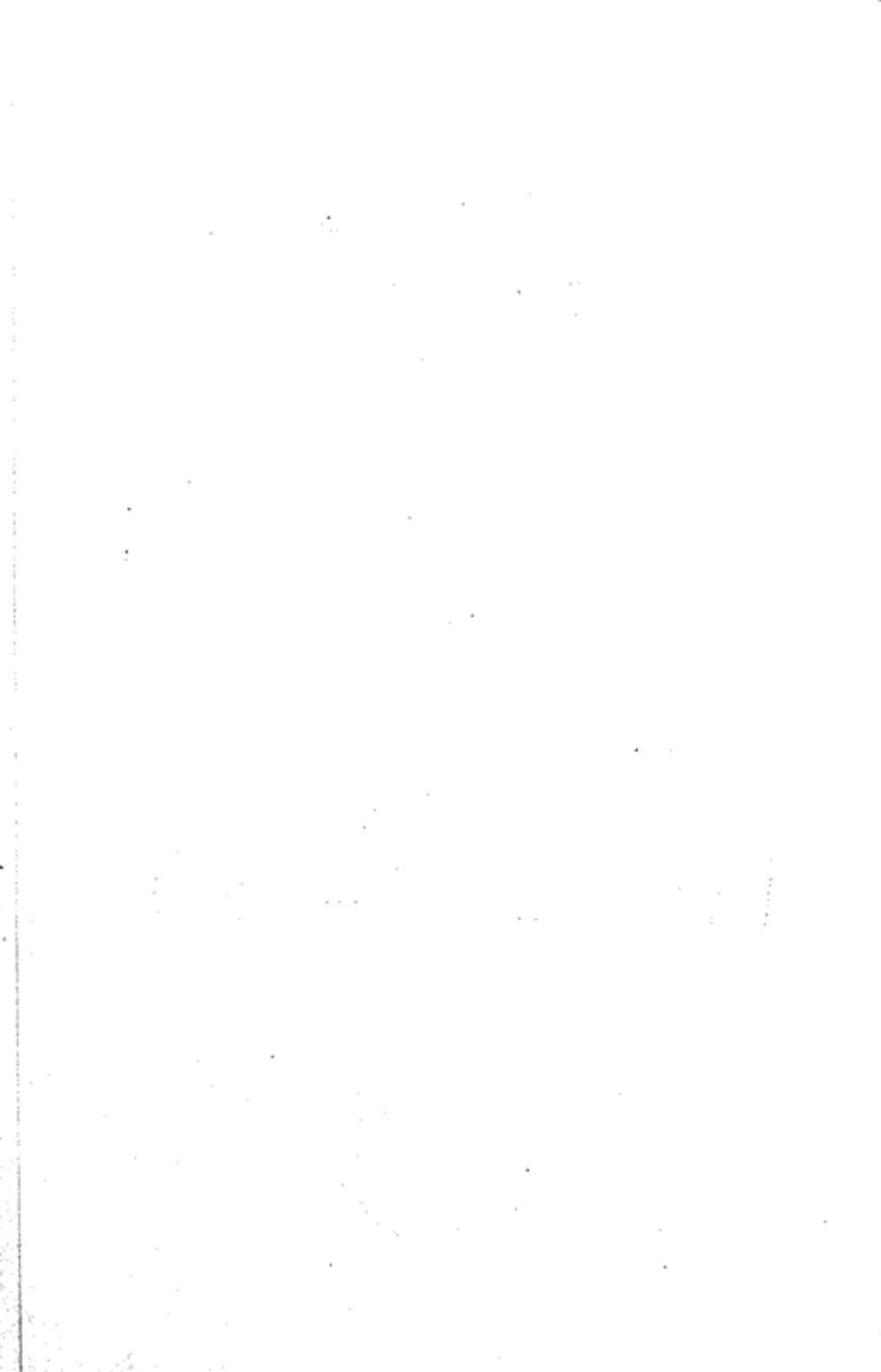


Diagram of the Scheme of Blood Circulation according to the Indian medical writers.



"Of the ducts that bear the life-breaths (*prānavaha*) the root is the heart and the great duct (*mahā-srota*). Beholding a person inhaling and exhaling long breaths or breathing obstructively or breathing furiously or drawing short or incessant breaths or breathing with noise or pain, the physician should understand that those ducts of the man that bear the life-breaths have become disordered." (C.S. III. 5. 5). It is clear from the above quotation that by the great duct (*mahā-srota*) is meant the trachea and the other ducts must mean the bronchi. This contention is further supported by the fact that two *vāyus* — the *prāna* and *udāna* are mentioned as located in the chest. Charaka mentions as the seat of the *prāna vāyu* the head, the chest, the ears, the tongue, the mouth and the nose (C.S. VI. 28. 5) and the chest and throat as the seats of *udāna vāyu*. Susruta speaks of *prāna vāyu* as flowing in the mouth. Vāgbhaṭa describes the *prāna vāyu* as staying in the head and from here coursing down to the throat and thorax. Sārangadhara, a 13th century writer, gives the heart as the primary seat of this *vāyu*. He further states that the *udāna vāyu* dwells in the lungs. It is quite evident from the above statements that the air enters through the nose, mouth and throat and finally the heart and lungs. There is another very interesting passage about respiration in Sārangadhara. "The *prāna vāyu* after coursing through the interior of the lotus-like heart goes out through the throat to drink of the outside air, and after taking up the nectar of the air it enters the body again to nourish the whole body and to keep up the digestive fire."² Charaka describes among the functions of *vāyu*, inhalation and exhalation, proper actions of speech, mind and body, regulation of the mind, the origin of joy and cheerfulness, and the excitement of the body fire. (C.S. I. 18.55 and C.S. I. 12.6). Of these, respiration is mentioned as one of the functions of the *prāna vāyu*, productions of sound, speech, etc., and effort as functions of the *udāna vāyu*, and excitement of the digestive fire as that of *samāna vāyu*. The above functions of the *vāyus* may be taken as a general statement of the functions of respiration. That the expired air contained water vapour was known. Charaka says "of the ducts that bear water, the root is the palate and also the lungs (*kloma*). Beholding the dryness of the tongue, the palate, the lips, the throat and the lungs, as also excess of thirst, the physician should understand that those ducts which bear water have been disordered." (C.S. III. 5. 6). The implication seems to be that the lungs manufacture water and keep the throat, palate, tongue and lips moist.

THE NERVOUS SYSTEM : The brain was differentiated from the head even in the Atharva-veda (A.V. x. 2). But Charaka and Susruta do not seem to have been clearly aware of this distinction. Charaka uses the general term head (*siras*) instead of brain (*mastiṣka*) in many places. Thus in C.S. I. 11.47 he states that the vital parts are the limbs, the heart, the head and the like. Again in C.S. I. 17. 12 he defines the head as that part of the body in which the life-breaths are said to inhere, to which all the senses are said to belong and which is said to be the most important of the limbs of the body. It is not quite clear whether he meant this in any deeper sense or simply that the sense organs of ears, eyes, nose and taste are situated in the head. Susruta quotes the opinion of Saunaka that the head is the only organ that makes the functions of all other organs possible (S.S. III. 3. 18). Describing the diseases produced by *vāyu*, he says the aggravated *vāyu* finds lodgment in the regions of the head, heart and temples. It presses upon those parts and gives rise to convulsive movements of hands and legs or at times bends them (S.S. 11.1.56). As was mentioned in the chapter on anatomy, Susruta held the four pairs of sensory nerves carrying the sensory impulses from the sense organs, viz., the optic, auditory, olfactory and gustatory nerves, to be attached to the brain inside the skull on the upper part of it. Bhela, who dates back as far as Charaka, considered the brain to be the centre of the *manas* or mind. He says "The *manas* which is the highest of all senses has its seat between the head and the palate. Being situated there, it knows all the sense objects and the tastes which come near it." (B. S. Chapter on Unmāda Chikitsa — C. U. Edition). It may be mentioned in this connection that the Sāmkhya and Vaiśeṣika systems, to which Āyurveda is largely indebted for its physiological ideas, consider the *manas* or the mind organ, a separate sense.

Though the head and brain are occasionally mentioned as the seat of some of the senses, Charaka and Susruta held that the heart was the chief centre of sensation, consciousness, *manas*, etc. "The body consisting of the limbs, knowledge, the senses, the five objects of the senses, the soul as invested with attributes, the mind and the thoughts, are all established in the heart. One gets swoons or loss of consciousness from wounds inflicted on the heart and death from the bursting or piercing of that organ." (C.S. I. 30. 45). As was mentioned in the chapter on anatomy, Susruta held that the four *dhamanis* which go crosswise and ramify in the skin carry pleasurable and painful sense impressions to the heart. Describing the distribution of the *dhamanis*

starting from the heart, he gives eight for the carriage of sound, sight, smell and taste, though, as stated above, he traces the same in another place to the brain.

Charaka has some valuable observations to make on the senses and sense perceptions. There are five senses constituted of five materials and they have five abodes, five objects and five kinds of perceptions. The five senses are vision, hearing, smell, taste and touch. The materials that enter into their composition are *ākāśa*, air, light, water and earth. Their abodes are the two eyes, the two ears, the nose, the tongue and the skin of the whole body. Their five objects are sound (*śabda*), touch (*sparsa*), form (*rūpa*), taste (*rasa*) and smell (*gandha*). The five perceptions derived from them are perception of form through vision, etc. Although the senses have for their essence modifications of all five primal elements, yet the element of light specially predominates in the sense of vision, *ākāśa* in hearing, earth in smell, water in taste, and air in touch. The sense in which a particular element predominates is regarded as having by virtue of that a special capacity for grasping that element. Unless led by the mind the senses cannot act. The five sense-perceptions are produced through the contiguity of the senses, the objects of the senses, the mind and the soul. These perceptions are transitory and are also of a determinate nature (C.S. I. 8. 1-9).

The nervous system of the Tantras is not dealt with in this study. It is entirely different from that described by Charaka and Susruta and has no connection with Indian medicine.

THE BODY-FIRE OR HEAT: Length of life, complexion, strength, health, exertion, growth, lustre, *ojas*, energy, animal and other kinds of heat and the life-breaths have all been said to be based on digestive fire. When this becomes extinct, a person dies. When it burns brightly in the body, one lives long without ailments of any kind. When it is vitiated one is afflicted, with disease. For these reasons, this fire is said to be the root (of all) (C.S. VI. 15. 2 and 3). As we have seen in the section on digestion there is a different fire for the production of each of the *dhātus* and for the digestion of the various ingredients of food. Thus the later Indian medical writers give five *bhūtāgni*s, the digestive fire for the digestion of the five elements contained in food and seven *dhātvāgni*s for the conversion of the seven *dhātus* from the *rasa*. Susruta maintains that the internal fire and *pitta* are identical. (S. S. 1. 21. 9). Charaka in VI. 15. 3 maintains that the internal fire is quite independent of *pitta* but in C.S.I. 17. 113 he states that digestion is due to the heat of the *pitta*.

ANALOGY BETWEEN GREEK AND INDIAN VIEWS ON PHYSIOLOGY: Many of the views described in this chapter bear a close resemblance to those of Greek writers of the same and succeeding centuries. Empedocles (504-443 B.C.) held that the body was composed of four elements: earth, water, fire and air.³ "Hippocratic physiology is wanting in strict coherence as a result of the heterogenous origin of the individual writings. We find writings the theory of which takes one or other of the four elements as its starting point, air, or fire, or fire and water; others in which antagonism of the qualities of warm, cold, dry and moist, of sharp, sweet and sour plays the chief part; finally those in which the origin of all phenomena is traced to the body humours, which were looked upon as representing the cosmic elements and their qualities or as particular modifications of these."⁴ In the work entitled "Ancient Medicine" in the Hippocratic collection, the author expresses his views on food, its composition, its strength, taste and other qualities and its effect on the constitution of the individual. These views bear a close resemblance to those of the Indian medical writers mentioned in the sections on food, its composition and qualities. "The fundamental principle of life is the inherent warmth of the body which has its seat in the left heart. Under the influence of this inherent warmth elementary fluids of the body are formed from food and from variable admixture of these fluids, solid parts of the body are formed. The diversity of the organ is explained by different degrees of influence exercised by the warmth upon the primary matter. Blood is the chief material from which organs are built up; it is produced in the liver."⁵

As is well known, the chronology of the various books of the Hippocratic collection is a very vexed question. But this difficulty does not arise in connection with the works of Aristotle which occupy the period between 384 and 322 B.C. The views on digestion held by the Indian medical writers bear a very close analogy to those of Aristotle, which are summarised as follows by William Ogle (1912) in Aristotle's "De Partibus Animalium". "The food is masticated in the mouth, but not otherwise altered, reaches the stomach, where it is concocted; the heat for this purpose, which is not common heat but a heat with special powers, being supplied by the liver and spleen, which are hot organs in close contiguity with the stomach. The solid and indigestible portion passes off by the lower bowel, but the fluid portion, which alone can partake in nutrition is absorbed by the blood-vessels of the stomach and the intestines. The

matter thus absorbed passes up to the heart in the form of vapour not as yet being blood, but only an imperfect serum. In the heart and vessels it undergoes a second concoction, these being the hottest parts of the body, and by the second concoction the serum is converted into blood. The blood when made passes from the heart by the vessels (arteries and veins alike) being mingled with air inhaled by the lungs and thence conveyed to the heart and is carried to all parts of the body. Each organ selects from the common stock those materials which it requires. The nobler parts, such as the flesh and the organs of sense, take the choicer elements, while the inferior parts, as bones and sinews, are fed on the inferior elements or leavings of the former. Thus every part of the blood that can be turned into account is utilised; but such as from its quality is unfit for use, for instance any bitter substance, is excreted as bile, urine, sweat, etc., in company with the matter which results from the decay of the parts themselves. Such surplus of nutritious matter as there may be after all parts are satisfied is either stored up in the body as fat or the like or passes out to form hairs, scales, feathers and other cutaneous appendages."⁶ Charaka also compares the process of digestion to the process of cooking (*pāka*). The digestive fire remaining below, cooks the food in the stomach converting it into *rasa* (C.S. VI. 15. 7). Susruta mentions a special kind of fire — *pāchakāgni* — in connection with digestion. The *pāchakāgni* is located in the region between the stomach and the intestines and helps the digestion of the four kinds of food. Since the stomach is situated above the *pittāsaya* and is endowed with a property contrary to the primary virtue of *pitta* and since the heat emitted by the receptacle of *pitta* is naturally radiated in an upward direction, the four kinds of food brought into the stomach are boiled and transformed into a soft placid mass (*rasa*) (S.S. I. 21. 51). The *dhamanis* connected with the place of *pitta* (*pittāsaya*) draw downwards the materials not fit for being absorbed and nourish the body with the assimilable products of digestion. They carry the food-juice throughout the body, as soon as it is digested by the action of heat, by supplying it to the upper circulatory *dhamanis* and through them to the heart, which is designated as the seat of *rasa* (S.S. III. 9. 6). Charaka and Susruta maintain that the food is digested by a process of primary cooking and the *dhātus* by a subsequent cooking *pāka*, of the *rasa* "a second concoction". The conception of Aristotle that bile, urine, sweat, hairs, scales, feathers, etc. are formed from that part of the blood which is unfit for use, closely resembles the views of Charaka on the production of the

waste-products or *malas* already described. Aristotle's conception of the composition of the body in three degrees, viz., the first degree out of what some call the elements, i.e., earth, air, water and fire, and the second degree by which the homogeneous parts of animals, such as bone, flesh and the like, are constituted out of the primary substances, bears a close resemblance to the views on the subject held by the Indian medical writers.⁷ Aristotle describes suet or fat as of earthy nature—containing a small proportion of water and chiefly composed of earth. We have seen that the Indian medical writers describe it as concocted from the earthy and watery parts of the food. Aristotle's views on heart and circulation of blood bear a close resemblance with those of Susruta on the subject. Like Charaka and Susruta, Aristotle held that "the motions of pain and pleasure and generally of all sensation, plainly have their source in the heart and find in it their ultimate terminations." He also held that the heart was the seat of the soul. With regard to circulation he held that "blood came originally from the materials in the *primae viae*, absorbed by fine terminals of the vessels in the bowels and, being used up in the organs, did not return. It was not propelled but moved in tides to and fro as the sea in the straits of Euripus, determined by irrigation of the tissues or in obedience to some vibratory quality of its own."⁸ Describing the details of circulation, Aristotle writes: "The water courses in gardens are so constructed as to distribute water from one single source or fount into numerous channels which divide and sub-divide so as to convey it to all parts. Now just after the same fashion has nature laid down channels for the conveyance of the blood throughout the whole body, because this blood is the material out of which the whole fabric is made. This becomes very evident in bodies that have undergone great emaciation. For in such there is nothing to be seen but the blood vessels; just as, when fig leaves or vine leaves or the like have dried up, there is nothing left of them but their vessels."⁹ This passage is reminiscent of the following description of Susruta's. "The vessels, the *sirās* carrying blood by their contractibility and expansibility, sustain and nourish the organism in the same manner as streamlets and canals serve to keep a field or a garden moist and fruitful. From the principal or central trunks hundreds of small minute vessels branch off and spread all over the body, just as small or minute fibres are found to emanate from the large central vein of the leaf of a plant." (S.S. III. 7. 2).

CHAPTER III

THE DOCTRINE OF TRIDOSA

The doctrine of the *tridoṣa* plays an important role in ancient Indian medicine. It is the basis of its diagnosis, pathology, and therapeutics. A correct appreciation of it is, therefore, essential for a proper understanding of Indian medicine. Many of its modern exponents have displayed more learning than judgment in their interpretation of it. There are many difficulties connected with a correct interpretation of this doctrine, which, as it has come to us, is an elaboration of a simpler one based on the early cosmological speculations of Indian philosophers. Evidences of this early form of the doctrine are found in the *samhitas* of Charaka and Susruta. In the later medical works it underwent great elaboration owing to the influence of the cosmological speculations of the well known systems of Indian philosophy on medical thought and consequently suffered much violence to make it fall in line with them. The correct approach to this problem lies in unravelling the origins of the doctrine from the very beginning and tracing its development through the various schools of Indian medical thought.

The term *tri-dhātu* occurs in the Rigveda 1. 3. 6. So also some of the germinal ideas of this doctrine, such as the conception of the body being composed of a certain number of elementary bodies called *bhūtas*, the idea of *dhātus* as supporters of the body, and of *doṣas* as the microcosmic representatives of the cosmic powers, are all traceable to the same source. The hymns of the Rigveda are now held to represent the experiences of the Aryan tribes as they established themselves among 'hostile aborigines' of the north-west of India. They are most probably Indo-Aryan in origin. This may explain certain similarities which are discernible between ancient Indian and Greek Medicine.

Classical Indian medicine discarded to a great extent the animistic beliefs which were so characteristic of Vedic medicine. "Medical thinking, in analysing man and his environment, in diagnosing diseases and prescribing therapies, adopts a scientific, non-theological view of the entities and energies concerned."¹ "The doctrines of the human body, as well as the greater part of

diagnosis and therapy in classical Hindu medicine are based on the concept of certain principal constituents or elementary substances (*bhūta*, *dhātu*) which pervade the organism and maintain its functioning.”²

These concepts were taken over from the cosmological speculations of Indian nature philosophers, who considered matter to be composed of a certain number of elementary bodies called *bhūtas*. Even as early as the Upanishads this idea is traceable. The Upanishads speak of five elements (*bhūtas*), viz., Space (*ākāśa*), Air (*vāyu*), Fire (*agni*), Water (*ap*) and Earth (*prithivi*) (A.U. III. 5. 3). Each of these has its own distinctive quality. Space is characterised by sound (*śabda*), air by touch (*sparsa*), fire by colour (*rūpa*), water by taste (*rasa*) and earth by odour (*gandha*). This concept was accepted by all the later schools of Indian philosophy, particularly by the Nyāya-vaiśeṣika school, to which ancient Indian medicine was indebted for its metaphysical ideas.

The Indian medical writers regarded the body as a conglomeration (*samudāya*) of the modifications of the five elements (*bhūtas*), water (*ap*), fire (*tejas*), air (*vāyu*), earth (*prithivi*), and ether (*ākāśa*). These modifications, which co-operate together to uphold the body, are called *dhātus*. The body functions properly so long as the *dhātus* in it are in proper proportions (*sama-yoga-vāhin*). Even in healthy persons their proportions are constantly undergoing fluctuations. Their normal measure (*prākṛti-māna*) is that amount of excess or deficiency that does not produce trouble or disorder of the body. When the *dhātus* are in their normal measure they are said to be in equilibrium and this state is called *dhātu-sāmya*. When their normal measure is either increased or decreased, their equilibrium is upset and this state is called *dhātu-vaiṣāmya* (C.S. IV. 6. 1-15).

The *dhātus* are formed from the ingested food. The food after digestion is converted into a pure portion called *āhāra-prasāda*, which is fit to be built into the system and a portion called *kiṭṭa* or *mala*, which is the refuse after the pure portion is drawn off. From the pure portion (*āhāra-prasāda*) are produced successively the *dhātus* proper, viz., *rasa* (food juice), *rakta* (blood), *māmsa* (flesh), the *medas* (fat), the *asthi* (bone), the *majjā* (marrow) and the *sukra* (semen). These *dhātus* are called *prasāda-dhātus*. The impure portion, the *kiṭṭa* or *mala*, is not fit to be built into the system but only for excretion. Besides the *kiṭṭa* or *mala* that is produced from the food after digestion, the *dhātus* (the constituents of the body) themselves,

during their production, throw off a refuse (*mala*) which is not fit to be built into them, and the portions thus discarded are known as *dhātu-malas*. "From the refuse (*kiṭṭa* or *mala*) of food arise urine, sweat, faeces, *vāyu*, *pitta* and *kapha*. The impurity of food is excreta and urine, that of *rasa* is *kapha*, that of flesh is *pitta*, and that of fat is sweat." (C.S. VI. 15. 5-10). The term *kiṭṭa* or *mala* includes all the waste products produced in the body, those produced from the food (*kiṭṭa*) as well as those produced from the *dhātus* (*dhātu-malas*). But of all waste products (*malas*) *vāta*, *pitta* and *kapha* are considered primarily responsible for all the morbidities of the body. As will be shown later, for the production of a disease three things are necessary, *nidāna*!, the *doṣas* and the *dhātus*. The *nidānas* or causes of disease, cannot produce disease directly. They first vitiate the *vāta*, *pitta* and *kapha*, and these in their turn vitiate the *dhātus* and produce disease. Because *vāta*, *pitta* and *kapha* are the vitiators of the *dhātus*, they are called *doṣas*, while the *dhātus* which are vitiated are called the *dūṣyas*.

There are constantly produced in the body, as a result of digestion of ingested food, two products, the *dhātus* and the *kiṭṭa* or *malas*. *Vāta*, *pitta* and *kapha*, which are *malas* in their origin, are differentiated as vitiators or *doṣas*. So we have three substances in the body, the *doṣas*, the *malas*, and the *dhātus*. Susruta says the human body is constituted of the *doṣas*, the *malas*, and the *dhātus* (fundamental constituents). (S.S. 1. 15). Again he says the *vāyu*, *pitta*, and *kapha* should be considered as the primary and most essential factors, in the constitution of the human organism. These fundamental and vital *doṣas*, occupying respectively the lower, middle and upper parts of the body, maintain its integrity. (S.S. 1. 21). Again specifically of the waste products, he says the excreta, urine, etc., are indispensably necessary for the preservation of the body. When they decrease below the normal measure they should be increased and when they increase they should be checked or remedied and brought to their normal measure. (S.S. 1. 15). These statements give us an idea of the theory of waste products held by Indian medical writers. They held that these waste products or *malas* (including the *dhātu-malas*), when in their normal measure support the body and hence should be regarded as *dhātus*. When either excessive or deficient, they upset the equilibrium of the *dhātus* and cause trouble to the body. Thus Charaka says that both the *prasāda-dhātus* and the *mala-dhātus*, in their proper measure, co-operate in sustaining the body. (C.S. I. 28. 3). The agent which upsets the equilibrium of the *dhātus* is considered by

Charaka to be food. The different constituents of the body grow when articles of food having similar attributes or constituents are taken, and become attenuated or decay when articles of food having opposite qualities are taken. (C.S. IV. 6. 10). The use of beneficial food is the only cause of the growth of a person ; while the use of food that is injurious is the cause of disease. (C.S. I. 25. 29).

The terms *dhātu*, *kiṭṭa*, *mala*, and *doṣa*, require precise definition. *Dhātus*, including the *prasāda-dhātus* and the *mala-dhātus*, are modifications of the five elements (*bhūtas*) which co-operate together to uphold the body. *Kiṭṭa* or *mala* is the refuse derived from the food after digestion, which is unfit to be built into the *dhātus* and fit only to be excreted. A distinction is made between the two terms, *kiṭṭa* and *mala*, the former being the waste-product of the food after digestion, while the latter is used to signify *kiṭṭa* or refuse above or below the normal quantity (*prākṛti-māna*) necessary for the maintenance of health, that is to say, in quantities capable of upsetting the equilibrium of the *dhātus* and producing disease. The *malas* include those produced from food and also those derived from the *dhātus*, i.e. the *dhātu-malas*. The term *doṣa* is applied to the *malas*, *vāyu*, *pitta* and *kapha*, in their capacity as vitiators of the *dhātus* when they are disordered by the various *nidānas*. They are termed *dhātus* when in their normal measure. Thus, *dhātus*, *malas* and *doṣas* are differentiated according to whether they function as supporters of the body or as vitiators of its proper functioning. *Vāyu*, *pitta* and *kapha* are *malas* from the point of view of their origin ; they are *dhātus* when in their normal measure, and they are regarded as *doṣas* when they become vitiators of the *dhātus*.

Vāgbhaṭa I takes a different view. He considers *dhātus*, *doṣas* and *malas* different entities and distinguishes the *dhātus* from *vāta*, *pitta* and *kapha*, calling the latter polluting agents (*doṣas*) and the former the constituents which are polluted (*dūṣya*). Charaka also makes this distinction, describing the *doṣas* as vitiating agents and the *dhātus* as the constituents which are vitiated. But, unlike Charaka, who derives the *doṣas* from the *malas*, Vāgbhaṭa denies that *malas* can be the cause of disease.

Vāgbhaṭa II considers the *dhātus*, *doṣas*, and *malas* different entities, assigning definite functions to each of them. He does not regard *dhātu-sāmya* as health and *dhātu-vaiśāmya* as disease, but *doṣa-sāmya* as health and *doṣa-vaiśāmya* as disease. As the *doṣas* are independent entities from the *dhātus*, a disturbance of the former need not necessarily be a disturbance of the latter.

With the advancement of medical thought in the various medical schools this simple doctrine, that health is the equilibrium of the *dhātus* and ill-health is the upset of this equilibrium, and that the agent that causes this is food, underwent further elaboration. It was considered insufficient to postulate that the body was a product of the *dhātus* and health the equilibrium or harmony among them. It was also considered necessary to postulate one or more inherent dynamic principles for the growth of the body and cause of disease. Physiological thinking in the medical schools was much influenced by the idea of the parallelism between the macrocosm and the microcosm. It was believed that the principal forces and faculties which abide in the organism, giving it life and supporting its processes, were microcosmic counterparts of the powers which pervade the cosmic body and maintain it through their various antagonistic and co-operative activities. The powers which pervade the cosmic body are the sun, moon and air. Thus in C.S. IV. 5. 1.2-4 Punarvasu says : "*Puruṣa* is like unto the universe. As many particular entities endowed with form as occur in the universe, so many occur in *puruṣa*. The universe is made of six ingredients. They are : earth, water, fire, air, ether and Brahman. *Puruṣa* is made up of the same six ingredients ; of that *puruṣa* the form is earth ; liquid secretions are water ; the animal heat is fire ; the life breaths are air ; the hollow spaces are ether ; and the inner self is Brahman." The root from which this knowledge (*pravṛtti*) arises is the conviction of the identity of man and the universe. In another discussion recorded in C.S. 1. 12, Varyovida describes the cosmic functions of air and contrasts it with the functions of *vāyu* in the body, observing that the just proportion of *vāyu* leads to health, the growth of strength, good complexion, etc. The son of Marichi says that the heat dwelling in the body within the *pitta* when excited produces evil and when in its normal condition leads to beneficial results. Kasyapa says that the *soma* that dwells in the body, within *kapha*, unexcited and excited produces beneficial and evil consequences respectively. These discussions seem to indicate that before Ātreya's treatise was written, attempts were made to explain the physiological functions of the body in health and disease by referring them to the operation of one operative principle. "The advance of medical schools of thought over the speculations which consider the body to be a product of one *bhūta* or many *bhūtas* is so sought in this, that, besides allowing the material causes (*upādāna*) of the body to be *dhātus*, they emphasized the necessity for admitting one or more inherent dynamic principles for the development and decay of the body.

This explains how *vāta*, *pitta* and *kapha* are regarded both as *dhātu* and *doṣa*, as *prakṛti* (normal) and *vikṛti* (abnormal)."³ Charaka and Susruta postulate not one but three inherent dynamic principles, corresponding to the powers of nature, viz., the sun, the moon and the air.

The *tridoṣa* theory was not fully developed until the above-mentioned three powers were identified with definite entities found in the body; *vāyu*, *agni* and *soma* were identified with *vāta*, *pitta* and *kapha* respectively. We have already seen how the *vāyu* of the universe was identified with that in the body, the fire dwelling in the body with the bile, and the *soma* dwelling in the body with *kapha*. It may be asked, says Susruta, whether there is any other fire besides *pitta* in the system or is the *pitta* fire itself. The answer he gives is that no other fire can be made out in the body. Owing to the heating nature of *pitta* it acts like fire in the functions of burning and digestion and forms the internal fire of the body. When this grows weak, it can be increased by taking food which increases *pitta*, and when it is in excess it can be relieved by cooling treatment. We see also that in the *Āgama* it is stated that *pitta* is fire. With regard to *kapha*, he says that the actions of *pitta* and *kapha* have been compared to those of the sun and the moon on the earth. *Soma*, *kapha* and *śleṣhma* are used as synonyms in Indian medical literature. As *soma* (moon), *sūrya* (sun), and *anila* (*vāyu*), maintain the earth by imparting, taking away, and diffusing power, so *vāyu*, *pitta* and *kapha* maintain the body by analogous actions. Thus Susruta considers *vāyu*, *pitta* and *kapha* the three microcosmic representatives of the three divine universal forces, *vāyu*, *agni* and *soma* respectively. The moon (*soma*) pours down renewal of the sap of life; the *vāyu* moves to and fro in various directions; the sun (*agni*) by its draining rays withdraws the sap from creatures. Thus they support the body of the universe. In like fashion, the analogous activity of *kapha*, *pitta* and *vāyu* supports the microcosm. (S.S. 1. 21).

Charaka and other medical schools recognise only three *doṣas*. Susruta differs from them in his view that these are four. "The *vāyu*, *pitta* and *kapha* should be considered the primary and most essential factors in the constitution of the human organism. These fundamental and vital factors, occupying respectively the lower, middle and upper parts of the body, maintain its integrity. These three factors, in combination with a fourth, the principle of blood, determine the origin, preservation and dissolution of the animated organism and permeate it with their respective properties till the moment of death." (S.S. 1. 21. 3). This

would imply that Susruta recognises not a triad but a tetrad of *doṣas*. Blood is one of the *dhātus* and so is one of the constituents of the body which can be vitiated and not a vitiator. The body *doṣas* are never aggravated independently of the blood; their aggravation goes together with a disturbed or agitated condition of the blood. Blood, being a liquid *dhātu*, is capable of transporting the *doṣas* to the various tissues. Owing to a natural similarity between blood and *pitta*, and (through) a natural affinity between their attributes, causes which tend to aggravate the deranged *pitta* tend to corrupt or agitate the blood as well. The *doṣas* are aggravated first and then the blood, just as in the case of all other tissues (*dhātus*). So in the strict sense blood cannot be called a *doṣa*. There have been other schools of medicine teaching a tetrad of *doṣas*. Thus, in the Bower MS., in a discourse about the actions of various medical drugs, we read "In the rainy season they are said to cure diseases due to disorders of air-humour; in the autumn they are held to cure diseases due to derangement of the bile; in the summer they are held to cure diseases due to derangement of blood; in the spring they are said to cure diseases due to derangement of phlegm." Commenting on this passage, Hoernle remarks: "The present passage appears to teach a tetrad of *doṣas*, viz., air, bile, phlegm and blood. The introductory verse names only a triad of humours (*doṣa-trāya*), viz., air, bile and phlegm. There is here an apparent inconsistency. But there have been older schools teaching a tetrad of humours. There are passages, even in Susruta, which imply, though inconsistently, that *rakta* or blood is one of the humours. The passage quoted above however, does not imply a tetrad of humours. The term *doṣa* may not have been used in its technical sense; as may be seen from the fact, that in V. 113 we have *rasa doṣa*, as if chyle was a fifth humour." ⁵ This question is of some importance as the mention of a tetrad of humours in Susruta and the Bower MS. is sometimes quoted as evidence of borrowing from the Greeks who postulated a tetrad.

Another question of importance is the relation of the *doṣas* to different constitutions. Susruta says that the temperaments (*prakṛti*) of persons may be of seven different types, according as the deranged *doṣas* of the body are involved therein, either severally, or in combination of two or of all the three together. The temperament (*prakṛti*) of a man is determined by the preponderance of the particular *doṣa* at the time of his generation and is marked by that predominant *doṣa* (S.S. III. 4. 57-58). According to Charaka, *vāyu*, *pitta* and *kapha* are three entities

always to be found in the bodies of creatures endued with life-breath. Some men, from the time of their conception in the mother's womb, have an equality or harmony of these three, whereas in others *vāyu* predominates, in others *pitta*, and in others *kapha*. People of the first category are always hale, while those in whom any one of the *doṣas* dominates are always subject to disease. The continued presence in the system of *doṣas* of this nature determines the character of one's constitution. (C.S. I. 7. 37-39).

We have already seen that *vāta*, *pitta* and *kapha* play the role of *vāyu*, *agni* and *soma* in the body. Charaka says "commencing from the moment of existence as foetus, the nature of human beings comes to be recognised as dependent on the predominance or otherwise of one or other of the three *doṣas*. *Kapha* is oily, smooth, soft, sweet, firm, thick, mild, moist, heavy, cool, slippery and transparent. In consequence of these qualities, persons in whose constitutions it predominates are described as having a body which is oily, smooth, agreeable to look at, delicate, clean, etc. *Pitta* is hot, keen, liquid, endued with the scent of raw meat, sour and pungent. In consequence of these qualities, persons in whose constitutions *pitta* predominates become incapable of bearing heat, their bodies are dry, delicate and void of filth etc. The *vāyu* without doubt is dry, light, restless, copious, fast moving, cool, rough, and transparent. In consequence of its dryness, persons in whose constitutions it predominates become endued with bodies that are dry, lean and small sized. (C.S. III. 8. 112-114). Charaka describes the characteristics of objects in which the *bhūta ap* (water) predominates as being liquid, oily, cold, mild, soft, unctuous, and mobile; the characteristics of objects in which the *bhūta tejas* (fire) predominates as being hot, keen, subtle, light, dry, and clear and largely endued with the attributes of form; and the characteristics of objects in which the *bhūta vāyu* (air) predominates as being light, cold, dry, sharp, clean, subtle, and largely endued with the attributes of touch. (C.S. I. 26. 22-36). The resemblances between these characteristics of the *bhūtas*, *ap*, *tejas* and *vāyu* to *kapha*, *pitta* and *vāyu* are very apparent. It is clear that the constitutions which exhibit the characteristic attributes of *vāyu*, *tejas* and *ap* were later designated as *vātaja*, *pittaja* and *kaphaja*.

The view that temperaments or constitutions do not depend on the predominance of *doṣas* but are '*bhautikī*' depending on the attributes of the predominating *bhūta* constituent is referred to by Susruta. He says, "Several authorities hold that the constituents

of the human body have their origin in the material elements of the body (*bhautikī*), the three constituent elements being air (*pavana*), fire (*dhahana*), water (*toya*), the characteristic traits of which respectively correspond to the *vātaja*, *pittaja* and *kaphaja* temperaments." (S.S. III. 4. 70-71). The Indian medical writers believed "that whatever attributes appertain to the nature of the ingredients, viz., the *bhūtas*, appertain also to their combinations and divisions". (C.S. I. 11.9). According to the predominance of any one of the *bhūtas* in the body there can be as many constituents as there are elements (*bhūtas*) entering into the composition of the body. The canonical number of five *bhūtas* (*pancha bhūtas*) seems to have been arrived at much later in Indian medical thinking. Brahman desiring to be many, created fire (*tejas*), water (*ap*), and earth (*kṣithi*). Then the self-existent Brahman entered into these three and it is by their combination that all other bodies were formed. All other things are produced as a result of an alloying or compounding of the parts of these three together.

The Chāndogya Upanishad explains all existing objects as a composition of these elements, fire, water and earth (Ch. U. VI. 2. 3. 48; VI. 4. 1). Later the Dhurttā Chārvākas held that there was nothing but the four elements, earth, air, water and fire and that the body was the result of atomic combinations. It is interesting to note that Susruta mentions only the three *bhūtas* corresponding to the three *doṣas* as the constituent elements of the body. We have seen that the three *doṣas* correspond to air, fire, and water. It is more logical to derive the temperaments or constitutions from the component *bhūtas* than from the *doṣas*. Susruta is aware of this fact and hence he correlates his *doṣa* classification of the temperaments with the more rational one based on the *bhūtas*. Charaka also denies the existence of *vātaja*, *pittaja* and *sleshmaja* temperaments or constitutions. What really happens, says Charaka, is that in consequence of the increase of any of the three *doṣas*, individuals come to be known as having constitutions with that particular *doṣa* predominating in them. If the *doṣas* are vitiated, such vitiation cannot in reason be regarded as one's normal condition. Hence, when *doṣas* predominate they can never be said to constitute one's nature or normal conditions (C.S. III. 6. 16-19). Charaka would much rather derive the constitutions from the constituent *bhūtas* though he does not expressly say so. This is clear from his deriving the attributes of the various temperaments from the attributes of the constituent *bhūtas* and denying the role of *doṣas* in their production. Another problem which has

never received a satisfactory answer is why only three *doṣas* were postulated when there are five *bhūtas*. Susruta suggests an answer to this question. He correlates his three *doṣa* temperaments with the three *bhūtas*, air (*pavana*), fire (*dhahana*) and water (*toya*) and suggests that several authorities hold that the constitution of the human body has its origin in the materials of the body (*bhautikī*) air, fire and water. This would imply that some authorities before his time held that the body was composed of these three *bhūtas*, air (*pavana*), fire (*dhahana*) and water (*toya*), and explained the attributes of the three recognised temperaments as the result of the preponderance of one or more of them. From this it would follow "that the doctrine of *vāta*, *pitta* and *kapha* is a later logical development of the view which regarded air (*pavana*), fire (*dhahana*) and water (*toya*) as the fundamental constructive principles of the body."⁶ Corresponding to these three *bhūtas*, three *doṣas* were formulated. When later the *pancha bhūtas* were recognised, the three *doṣas* were retained. Though Susruta mentions the possibility of seven temperaments on his *doṣa* classification, only three temperaments or constitutions have been recognised in classical medicine. Charaka and other writers speak only of three temperaments and not seven, showing that traditionally only three temperaments were recognised. It is interesting to note that in the Greek humoral theory, corresponding to the four elements, four humours were postulated.

The doctrine of *tridoṣa*, as it was finally evolved, is stated by Charaka in a few well known passages. The *doṣas* are three. They are *vāyu*, *pitta*, and *kapha*. When they are in their normal state, they are beneficial to the body. When, however, they become disordered, they afflict the body with diseases of diverse kinds (C.S. III. 1. 4). Whether these are in their normal or abnormal state the man of learning should seek to ascertain. (C.S. I. 18. 53). Intelligent physicians, observing the special seat or place, the indications and exciting causes, of *vāyu*, *pitta*, and *kapha* refer to all diseases as caused by disorders of *vāyu*, or *pitta* or *kapha*. (C.S. I. 19. 47). *Vāyu*, *pitta* and *kapha* have been said to be the cause of all bodily diseases. *Vāyu*, which may be dry, cold, light, subtle, unstable, clear, keen, is cured by objects which have adverse attributes. *Pitta* which may be cold, hot, keen, soft, liquid and bitter, is cured by objects which have adverse attributes. Heavy, cold, mild, watery, sweet, stable and slimy are the attributes of *kapha* and are cured by objects having adverse attributes. Those changes (in *vāyu*, *pitta* and *kapha*) that are curable may be set right by drugs pos-

sessing adverse attributes, administered according to considerations of place, measure, and time. (C.S. I. 1. 56-62).

What is the origin of the *doṣas* in the body? Charaka thus describes it. "As soon as food is taken, the six *rasas* (contained in the food) begin to be digested. Due to this digestion a sweet reaction sets in and due to this sweet reaction again is produced a foamy *kapha*. A little while after, the food when it becomes only half digested in the course of digestion, a sour reaction sets. The food in this state passes out of the *pakvāsaya*. There springs from it a liquid substance called *pitta*. When at last the digested food comes into the intestines, it begins to be dried up by the fire and is converted into a compact mass. During this process a bitter and astringent reaction sets in and due to this reaction *vāta* is generated." (C.S. VI. 15. 5-10). Again he says: "From the refuse (*kiṭṭa* or *mala*) of food arise urine, sweat, faeces, *vāyu*, *pitta*, and *kapha*. The impurity of food is excreta and urine, that of *rasa* is *kapha*, that of flesh is *pitta*, and that of fat is sweat." (C.S. I. 28. 3). From the above quotations it is evident that Charaka considered the *doṣas* as substances in the nature of internal waste products produced from the unabsorbed portion of the food after digestion, i.e., from the refuse (*kiṭṭa*) of food. Susruta also expresses a similar opinion. He says *kapha* is the excreted portion of the *rasa*, while *pitta* is that of the blood, whereas Charaka derives *pitta* from the flesh. (S.S. I. 46). This idea that during digestion waste products are produced and these waste products play an important role in production of disease was held by the Egyptians also and later by the Greeks.

THE SEATS OF THE *Doṣas*: According to Charaka the seats of *vāyu* are the urinary bladder (*vasti*), the intestines (*purīṣā-dhāna*), the pelvis (*kati*), the two thighs, the two legs and the bones. Of these, the intestines (*pakvāsaya*) are its special seat. The seats of *pitta* are the sweat (*sveda*), the *rasa*, the *lasikā*, the blood and the stomach (*āmāsaya*). Of these the *āmāsaya* is its special seat. The seats of *kapha* are the thorax (*uras*), the head (*siras*), the neck (*grīvā*), the joints, the stomach (*āmāsaya*) and the fat (*medas*). Of these the thorax (*uras*) is its special seat. (C.S. I. 20. 11). Susruta states that "*vāyu* resides between the hip bones (the *śroni*) and the anus (the *guda*), i.e., in the pelvic cavity. The seat of *pitta* is between the intestines (*pakvāsaya*) and the stomach (*āmāsaya*). The seat of *kapha* is the stomach (*āmāsaya*). Susruta's description is more precise and less diffuse than that of Charaka. (S.S. I. 21. 6).

THE NORMAL AND ABNORMAL ATTRIBUTES AND FUNCTIONS OF THE *Doṣas* : Dryness, lightness, clearness, coolness, motion, and formlessness are the attributes of *vāyu* by itself. In consequence of this, the indications of its abnormal functioning, as it exists in the different parts of the body, are : falling out, displacement, extension or enlargement, bursting of limbs, cheerlessness, joy, thirst, remorse, pain in the whole body, twitching, piercing pains, inflammations, painful sensations as if caused by the limb being tightly bound with cords, and fractures ; also roughness of the skin, hardness of the limbs, and absence of activity, perforations in the limbs, redness of complexion, astringent taste in the mouth, tastelessness in the mouth, severe pains of a local character, sweating, sleep, contractions and numbness or paralysis of limbs. When it shows these symptoms, the physician assigns the disease to the action of *vāyu* (C.S. I. 20. 22).

The attributes of *pitta* by itself are : heat, keenness, lightness, and slight oiliness ; in colour it is not white ; its scent is like that of raw meat ; its taste is two-fold, bitter and sour. In consequence of the true or unmodified nature of *pitta* by itself being so, the indications of its functioning, when it is in a modified or excited condition, penetrating into those parts of the body that constitute its seats, are burning, warmth, suppuration, sweat, impurities, gangrenous ulcerations, secretions, and redness. Its scent, complexion and taste when it undergoes modification by aggregation or excitement correspond to what they are in its normal state. When he sees these indications, the skilful physician should diagnose the disease as due to disorders of *pitta* (C.S. I. 20. 28).

The attributes or indications of *kapha* by itself are : whiteness, cold, heaviness, oiliness, sweetness, firmness, slimness, and softness like that of good earth or clay. In consequence of this, the indications of its excited state are that, entering those particular parts of the body that constitutes its seats, it produces whiteness of complexion, cold, itching, dullness, heaviness, oiliness, loss of sensation, tightness as if bound with cords, a sense of sweetness and procrastination in respect of work. When diseases are endued with these symptoms, the physician should attribute them to disorders of *kapha*. (C.S. I. 20. 34).

THE FUNCTIONS OF THE *Doṣas* : The functions of *vāyu*, when in its normal state, are : energy in respect of action and movements, inhalation and exhalation of the breath, the proper functioning of the physical organs (such as speech, thought, etc.), equable course of the several elements of the body and equable or proper discharge of excreta and urine and such other impuri-

ties as escape or are secreted out of the body. (C.S. I. 18. 54). Vision, digestion, the heat that is natural to the body, hunger, thirst, softness of the body, splendour of complexion, cheerfulness of mind, and intelligence are due to the action of *pitta* in its normal state. (C.S. I. 18. 55). All oily matter in the body, tightness of the joints, general tightness of the body, weight of the body, sexual power, strength, capacity to bear or endure, patience, and absence of renunciation of cupidity are due to the action of *kapha* in its normal state (C.S. I. 18. 56).

Charaka speaks of five *vāyus*. This is in accordance with a prevalent ancient belief, and this division of the *vāyus* into five is also mentioned in the Atharva-veda. These five are : (1) *Udāna*, in the throat, goes upwards and causes speech, music, etc. Those diseases which are caused by its derangement have their seat above the collar bone (in throat and head). (2) *Prāna*, in the heart, causes breath coming from the mouth that leads the food inside, and causes inward breath ; its derangement leads to hiccup, asthma, and similar diseases ; (3) *Samāna*, in the stomach and intestines, digests the food by the digestive fire and analyses it into its elements (chyle, excreta, urine, etc.) ; (4) *Apāna*, in the lower body, drives the faeces, urine, sperm, menses, and foetus below, and if deranged causes dangerous diseases of the bladder, anus, sperm, as well as diabetes ; (5) *Vyāna*, in the whole body, causes division of the fluids, the flow of sweat and blood and the moving and opening and closing of the eyes etc. (C.S. I. 17. 6). As for *pitta* and *kapha*, no attempt was made by Charaka to classify them, though he attributes various functions to them. Susruta, however, speaks of five varieties of each of them.

THE FIVE VARIETIES OF *Pitta* ARE : (1) *Pāchaka*, between the stomach and the intestines, causes the digestion and secretion of *rasa*, urine and excreta. Its derangement produces indigestion and acidity, a burning sensation in the heart, throat and stomach, thirst ; (2) *Ranjaka*, in the liver and spleen or in the stomach, colours the *rasa* and turns it into blood ; its derangement produces *rakta-pitta* and affects the liver and spleen. (3) *Sādaka*, in the heart, causes sight, determination and memory ; if deranged it destroys thinking power and produces stupor, apoplexy, etc. (4) *Ālochaka*, in the eyes, causes the faculty of seeing ; if deranged destroys sight. (5) *Bhrājaka*, in the skin, gives glaze to the skin and absorbs ointment ; if deranged produces diseases of the skin and changes its colour. (S.S. I. 21. 9-10).

THE FIVE VARIETIES OF *Kapha* ARE : (1) *Kledaka*, in the stomach, moistens the food and other places of *kapha* in the

body ; if deranged produces indigestion, loss of appetite, whiteness of faeces, urine, etc. (2) *Avalambaka*, in the heart, causes firmness of limbs ; if deranged produces sloth. (3) *Bodhaka*, in the tongue, brings about taste ; if deranged affects the sense of taste. (4) *Tarpaka*, in the head, oils and refreshes all sense organs ; if deranged produces loss of memory, and vitiates the senses. (5) *Sleşaka*, in the joints, makes the joints flexible ; if deranged produces heaviness of joints. (S.S. I. 21. 13 and 16).

From the discussion of the various constitutions and the symptoms of diseases it is easy to see that the resemblance of the attributes of *vāyu*, *pitta* and *kapha* to the attributes of the body in various constitutions is very remote ; yet, since the special features and characteristics of one's body were considered to be due to one or other of the body building agents (*bhūtas* or *doṣas*), these characteristics of the body were, through similarity, referred to them. The same reasoning holds good with regard to diseases. The resemblances between the symptoms of diseases and the attributes of the *doṣas* are also very remote, but since the *doṣas* were regarded as the causes of diseases, the symptoms of the latter were, through similarity, referred to them. "This attribution of a certain number of specific qualities to the *doṣas* may be due either to the fact that the *doṣas* were regarded as identical with *vāyu*, fire, and water in the body or to the belief that the qualities of effects were due to the quality of causes, i.e., the different qualities of our bodies considered as effects, the causes were also considered as having these qualities from which those of the effects were derived." ⁷

THE ROLE OF *Doṣas* IN THE PRODUCTION OF DISEASE : This subject is discussed in greater detail in the chapter on diagnosis. Different views on it have been held by different authorities. Susruta says : "*vāta*, *pitta* and *kapha*, are the roots of all diseases, as would appear from their signs or characters being seen in all diseases, from the results of experience, and the writings in the *sāstras*. Diseases assume various forms owing to the different modes in which the *doṣas*, the *dhātus*, and the *malas* are mixed up in particular cases, the different parts of the body in which they are deranged and the causes by which the disorders are induced. Diseases are classified according as the deranged *doṣa* affects the different *dhātus*. The deranged *doṣas* pervade the body, and where from their contact any tissue becomes affected, there the disease is set up. (S.S. I. 24. 8). When a *doṣa* is deranged to a small extent only, it remains in its passage. In the course of time, if irritated by some cause and there is nothing to check its progress, it becomes quite deranged." (S.S. I. 21. 29).

The *doṣas* of the system, viz., *vāta*, *pitta* and *kapha*, have three kinds of courses; "(1) they may be attenuated or remain in normal measure or be increased or excited; (2) they may range upwards or downwards or in transverse directions; and (3) they may travel into the stomach, the branches or subsidiary ducts or all vital parts and bone joints." (C.S. I. 17. 109-10). The *doṣas* do not increase or decrease in quantity spontaneously and not every increase or decrease of them constitutes disease. There are three things necessary for the production of disease: *nidāna* or the predisposing causes which vitiate a *doṣa*; or *doṣas* (faults); and *dūṣyas* or the ingredients or the *dhātus* of the body which are vitiated. When the *nidānas*, the *doṣas* and *dūṣyas* are mutually connected, a disease is produced. When there is no successive connection between these three, there is no disease. And when the connection is not thorough or complete or the causes are weak, a disease of a mild type is produced, not all the symptoms being manifested. (C.S. II. 4. 4).

Susruta describes the mechanism in greater detail. He describes five stages in the development of a disease: (1) *Caya*. The stage of aggregation or accumulation of *doṣas* in general; (2) *Prakopa*. The stage when the accumulated *doṣas* are spread through the system; (3) *Prasāra*. In this stage there is something like a fermentation of the *doṣas*. This is moved about by *vāyu*, which, though inanimate, is the cause of all motor activities. When a large quantity of water is accumulated at any place, it breaks the embankment and flows down and joining on its way with other streams, flows to all sides; similarly the *doṣas* also flow, sometimes alone, sometimes two conjointly, and sometimes all together. In the whole body, in half of it, or in whatever part the fermented *doṣas* spread to, the symptoms of disease are showered down, as it were, like water from the clouds; (4) *Pūrva-rūpa*. The manifestation of the premonitory symptoms (*pūrva rūpa*); (5) The full manifestation of the disease is the fifth stage or the *rūpa*. During this stage the characteristic symptoms of the disease manifest themselves. (S.S. I. 21. 18-39).

Though the attributes of the *doṣas* are mutually opposed to one another, they do not always neutralise one another, and can grow simultaneously violent in a system. When more than one of them is affected, the resulting manifestation of the combination is modified from what it would be if one alone were affected. The manifestation of one is more evident than the other. Thus Charaka speaks of the characteristics of the principal and the accessory *doṣas*. The chief manifestations are those of the principally affected *doṣa*, while the characteristics of the acces-

sory *doṣa* are not so evident. Charaka says generally of the *doṣas* dwelling in the body that in consequence of their belonging to the same place there may happen a commingling of any two or three. If the *doṣas* exist together, one being the principal and the other or others accessory, the co-existence of all three is called *sannipāta*, while that of any two is called *samsarga*. There are manifold distinctions due to the kinds of co-existence as principal and accessory. (C.S. III. 6. 11-12).

Again the disturbance of a *doṣa* does not necessarily mean that all its attributes have been exhibited in full strength ; it is possible for one or more of its attributes to be aggravated without disturbing the others. Hence it is necessary not only to discover which *doṣa* is aggravated but also which of its attributes. The nature of disturbance of a *doṣa* is determined by the nature of the disturbance of the attributes involved. Thus, though the *doṣas* are only three, the number of diseases they can give rise to is innumerable.

Different views have been held as to the nature of the *doṣas* by different schools of medicine. Are the *doṣas* only hypothetical entities standing as symbols of a number of symptoms, without any real existence ? In such an interpretation reality would belong to the symptoms and the agents of morbidity or the *doṣas* would only be convenient symbols for collecting certain groups of these symptoms under one name. Where there is one particular set of symptoms, it is to be considered that there is a disturbance of *vāyu* ; wherever there is another set of symptoms, there is a disturbance of *pitta* and so forth. But there are serious objections against such an interpretation.⁸ We have seen that both Charaka and Susruta consider the *doṣas* material entities and have described their physical characteristics, the particular sites where they reside in the body, their normal and abnormal functioning and the role they play in the production of disease. Charaka, as we have seen, derives the *doṣas* from the waste products or *malas*. Susruta also mentions them as being derived from the *malas*. These descriptions cannot be satisfactorily explained upon an interpretation which considers them to be hypothetical entities, having only methodological value and being no more than convenient symbols for a collective group of symptoms.

Some authorities consider the *doṣas* to exist in two forms, invisible (*sūkṣma*) and visible (*sthūla*). This conception is based on the views of Susruta about the existence of a constitutional variety of *doṣas*. As we have seen, Charaka denies that there is any such variety. The *doṣas* which are constitutional always

remain as the constant part engaged in their physiological operations. The later increase or deficiency of the *doṣas* has a separate course of action in producing diseases and there is no interchange between the later excess or deficiency of *doṣas* and the constitutional constant parts of the system known as *prakṛti*. As Dasgupta remarks, "though such distinction can doubtless be made, it has not been so distinguished in the medical literature, as it is of little value from the medical point of view; it does not help us to understand the real nature of the *doṣas*. The nature and function of a *doṣa* does not depend on the visibility or invisibility; nor can the visible *doṣa* be regarded as always the product of the invisible one."⁹

Another view which has been held as to the nature of the *doṣas* by the later writers of medicine, is that they are the three Sāmkhya Guṇās. The *Uttara-tantra* of Susruta compares the three *doṣas* to the three guṇās. Vāgbhaṭa I developed the idea of the *Uttara-tantra* and considered the three *doṣas* as the three guṇās. He says, "As the three guṇās co-operate together for the production of the world in all its diversity, in spite of the mutual opposition that exists among themselves, so the three *doṣas* also co-operate together, in spite of their natural opposition, for the production of the diverse diseases." (A.S. I. 22). Dalhaṇa identifies *vāyu* with *rajas*, *pitta* with *sattva*, and *kapha* with *tamas*. Susruta and Charaka do not share this view. Susruta compares the action of *vāyu*, *kapha* and *pitta* to that of air, moon and sun. "As the sun, moon and air maintain the earth by imparting, taking away and diffusing power, so the three *doṣas* maintain the body by analogous action." (S.S. I. 24. 41). Charaka does not mention the guṇās at all in connection with the *doṣas*. This view also does not throw any fresh light as to the nature of the *doṣas*. Dasgupta is right in his remark "in the *Uttara-tantra* and by Vāgbhaṭa I the Sāmkhya analogy of the guṇās seems to have had a very distracting influence, and instead of trying to find out the true physiological position of the *doṣas*, these writers explain away the difficulty by a reference to the Sāmkhya guṇās."¹⁰

We can be assured that the *tridoṣa* theory with its many modifications has had a long evolutionary period before receiving the final definition in the medical schools. This theory probably had its origin in the superficial deductions from the obvious facts of physiology that the animal body requires air, fluid and solid food; that too great heat and cold are fatal to life; that very many diseases are attended by fever; that fluid is a necessary factor in digestion and blood is in a peculiar way connected

with life and death. These simple observations were reinforced by the speculations of the nature philosophers, particularly of the school of Nyāya-vaiśeṣika. Some of the basic concepts were derived also from the theological beliefs handed down from Vedic times. The fundamental idea which runs through the early Hindu religious writings is that underlying the exterior world of change there is an unchangeable reality which is identical with that which underlies the essence of man. The essence in man and the essence of the universe are one. Physiological thinking in the medical schools has been much influenced by the idea of the parallel structures of the macrocosm and the microcosm, which formed a principal tenet of Vedic tradition. Even in the Atharva-veda diseases were referred to as those produced by water (*abhraja*), those produced by air (*vātaja*), and those by fire or those which are dry or burning (*suṣmah*) (A.V. I. 12. 3). Charaka also describes diseases as those relating to *agni*, those relating to *soma*, and those relating to *vāyu* (C.S. II. 1. 4). Thus the basic idea that air, fire and water have something to do with disease production was conceived. The theory admitted of many variations as we have seen above. In the Rigveda we read of attempts to derive the whole universe from a primordial substance like water. Later we see three, four, and five constitutional *bhūtas* or elements postulated. Susruta refers to a school of thought which considered that the constitution of the human body (*prakṛti*) is elemental (*bhautikī*), the three constituent elements being air (*pavana*), fire (*dhahana*) and water (*toya*). The attribution of a certain number of specific qualities to substances was due to the belief that the qualities of effects are due to the qualities of the causes. So, from the diverse qualities of our bodies considered as effects, the causes were also considered to have those qualities from which these effects were derived. The same process that is seen in the evolution of the Greek humoral theory is also seen here. First some qualities were postulated, i.e. the contraries: hot and cold, warm and moist, and then they were materialised into the humours. Air, fire and water were conceived first as powers. Then they were identified with *vāyu*, *pitta* and *kapha*. In this identification the medical schools were helped by their clinical experience. The three common diseases then known were gastro-intestinal diseases with flatulence, fever associated with burning heat and vomiting of bile, and chest diseases associated with copious sputum. Thus *vāyu*, *pitta* and *kapha* came to be substituted for air, fire (sun) and water (moon or *soma*). Susruta added blood to the list of *doṣas*. Amid all these differences, which by their

variety indicate that they belonged to theory without seriously affecting practice, there is one common principle, that health is the equilibrium of the *dhātus* and disease is the upset of their equilibrium.

CHAPTER IV

AETIOLOGY, CLASSIFICATION AND PATHOLOGY OF DISEASES

AETIOLOGY

There are three causes of disease, says Charaka. They are :— (1) the excessive, deficient, and wrongful administration of sense objects ; (2) the climatic characteristics of heat and cold ; and (3) the misuse of intelligence (C.S. I. 1. 53). Thus the sight of objects with powerful light, the hearing of loud sounds like the roaring of thunder, the smelling of very strong odours, excessive eating, contact with very hot and cold objects or excessive bathing or massage are examples of *atiyoga* or excessive association with sense objects. Not to see, hear, smell, taste or touch at all would be *ayoga* or deficient association with sense objects. To see objects very near the eye or at a very great distance, or to see frightful, hideous, unpleasant and disturbing sights, would be examples of the improper use (*mithyā-yoga*) of the visual sense. To hear grating and unpleasant sounds would be an example of the improper use of the ear ; to smell bad and nauseating odours would be an example of *mithyā-yoga* of the nose ; to indulge in eating articles of food having only one kind of taste or to exclude altogether articles of food of a particular taste or to include in one's diet articles of food whose combination is harmful, would be examples of the improper use of the tongue ; to be exposed to sudden heat or cold are examples of the improper use of touch. Similarly, all activities of speech, mind and body when performed to an excessive degree or not performed at all or performed in an undesirable or unhealthy manner are to be considered as examples respectively of *atiyoga*, *ayoga* and *mithyā-yoga* of the effort of speech, mind and body.

2. The climatic characteristics of heat and cold depend on the various seasons of the year. The special characteristics of the seasons are heat, cold and rain. When a particular season manifests its special characteristics of heat, cold or rain in excessive or deficient measure or in a very irregular or unnatural

manner, we have what are called *atiyoga*, *ayoga* and *mithyā-yoga* of time (*kāla*).

3. The misuse of intelligence. The misuse of intelligence or *prajnāparādha* is at the root of all excessive, deficient, or wrongful association with sense objects. When proper things are not taken or done at the proper time, this is classed as misuse of intelligence and is therefore included under *prajnāparādha*.

Charaka remarks : "The above-mentioned three causes constitute the cause of diseases. Connection therewith in normal or judicious proportions is the cause of health. The presence or absence of all objects which occur in the world, acts on the body. Such action, it is seen, takes place only through proper association, excess of association, and injudicious or improper association and not through any other means. In fact, the presence or absence of objects, for producing action on the body, depends upon contact or association with the body." (C.S. I. 11. 43).

As will be shown in the section on pathology, the *nidānas* or pre-disposing causes cannot produce diseases directly. They first act on *vāyu*, *pitta* and *kapha* which in their turn act on the *dhātus* or constituents of the body and produce diseases in them. Because *vāyu*, *pitta* and *kapha* vitiate the *dhātus* they are called *doṣas*. Charaka describes two kinds of *doṣas* or faults, bodily and mental. *Vāyu*, *pitta* and *kapha* are the *doṣas* (faults) of the body. *Rajas* (passion) and *tamas* (darkness) are the *doṣas* (faults) of the mind. Both kinds of *doṣas* have their specific exciting causes.

There are two modes in which the *nidānas* may act in producing disease. In the one called *Nija* form, they first set up an abnormality of the *dhātu*-equilibrium which results in the painful condition called disease. In the other, called the *Agantu* form, the painful condition is first produced and is followed later by the manifestation of abnormal *dhātu*-equilibrium. Injury, poisoning, etc., come under this heading. Diseases produced in the first way are called *Nija* diseases and those produced in the second way *Agantu* diseases. Though these two types of disease differ in their modes of causation, they are similar in their clinical manifestations after the disease arises.

Besides the general causes mentioned above, there are certain specific causes for the excitement of the *doṣas*. The following causes produce *derangement of vāyu* :—fighting with strong people, excessive exercise, venery or study, falling from a height, running, pressure (i.e., the body being much pressed), injuries, fasting, remaining in water, swimming, staying up at night, carry-

ing heavy weights, riding on elephants, horses or carts, or walking on foot ; articles with acrid, astringent or bitter tastes, dry, light or cooling things, dry herbs, and dry meat and certain varieties of cereals and pulses ; little food, irregular food, excessive eating, restraining by force *vāyu*, faeces, urine, semen, vomiting, sneezing, eructation, tears, etc. *Vāyu* is especially deranged in the cold, cloudy, windy, and rainy seasons, in the morning and evening and after digestion of food.

The following causes produce *derangement of pitta* :—anger, grief, fear, labour, fasting, indigestion, indulgence in sexual intercourse ; the use of acrid, saltish, pungent, hot, light, and indigestible articles of diet, sesamum oil, oil-cake, *kuluttha*, mustard seeds, linseed, flesh of the guana, fish, meat of goats and sheep, curdled milk, butter-milk, whey, fermented barley-water, spirituous drinks, acid fruits, acid, fermented liquids, etc. *Pitta* is especially deranged by heat, in summer and in autumn. During the day it is deranged at midday and midnight and when the food is being digested.

The following causes produce *derangement of kapha* :—sleeping during the day, want of exercise and idleness ; the use of sweet, acid, saline, cold, oily, heavy, emollient and demulcent articles ; certain varieties of rice, barley, wheat, gruel made of ground sesamum seeds, curdled milk, milk, rice and milk boiled together, preparations from the sugar-cane juice, meat of animals living in water or marshes, fat, tubers of water-lilies, sweet fruits of creepers, full meals, eating soon after a meal etc. *Kapha* is specially deranged in the winter and spring. During the day it is deranged in the morning and evening and immediately after eating.

The blood is deranged when pitta is deranged. It is also deranged by frequent use of liquid, oily, and indigestible food, sleeping during the day, anger, fire, exposure to sun, labour, injury, eating indigestible and incompatible articles of food, etc. As the blood is not deranged without one of the three *doṣas*, the time of its derangement should be inferred from that of the accompanying symptoms (S.S. I. 21. 19-25).

CLASSIFICATION OF DISEASES

Atharva-veda mentions five classes of diseases :—

1. Some atharvanic people recognized a threefold classification of all diseases : those produced by wind, by water and by fire (A.V. I. 12. 3). This corresponds to the later classification of all diseases as due to the three *doṣas*, *vāyu*, *pitta* and *kapha*.

2. Apart from ordinary diseases, many diseases were produced by possession by demons and evil spirits, of which quite a large number were known and named.

3. Diseases due to worms were well known, both in men and cattle.

4. There were also diseases due to sorcery, which played an important part as an offensive measure in Vedic India.

5. Many diseases were known to be hereditary (*kṣetriya*).

Though many diseases and many remedies are mentioned in the Atharva-veda, nothing in the way of *nidānas* or causes of diseases is specified except supernatural causes. The fact that there existed a threefold classification of diseases, *abhraja* (water), *vātaja* (wind), and *suṣma* (dry), should not be interpreted to mean that the Vedic people had any knowledge of the disturbance of these elements operating as *nidānas*, as they were understood in later medical literature. The three most important causes of disease according to the Atharva-veda were evil deeds, the sorcery of enemies and possession by evil spirits or anger of certain gods.

Charaka discusses in great detail the principles underlying the classification of diseases. Thus in *Vimāna Sthāna*, Chapter VI, he says "that there are two groups of diseases, judged by differences of origin or nature viz., curable and incurable. There are two groups of diseases judged by differences of strength, viz., mild and violent. There are two groups of diseases judged by differences of substratum, viz., those that have the mind for their substratum and those that have the body. There are two groups of diseases judged by differences of their causes, viz. those due to disorders of the constituent elements, and those due to accidental causes. There are two groups of diseases judged by difference of their seats, viz., those that arise from the *āmāsaya* (stomach) and those from the *pakvāsaya* (intestines). Thus although diseases, in consequence of origin, of nature, of strength, of substratum, of cause and of seat, are of two kinds, still, if distributed according to other causes of differences or unified, they become either manifold or only one. As regards unification, all the groups of diseases may be included under one head, in consequence of all having the common characteristic of being a disease. As regards diseases being manifold, there are ten groups of diseases, according to difference of origin and the rest." (C.S. III. 6. 1-3).

Charaka divides all diseases into three kinds : physical, accidental and mental. Physical diseases (*nija*) are those that arise from some abnormal conditions of the body. Accidental diseases

(*agantu*) are those that arise from the actions of spirits, of poison, of wind, of fire and of acts of violence done to the body such as beating, etc. Mental diseases (*mānasa*) are those that arise from the non-attainment of objects desired or coveted or from accession with those that are disliked (C.S. I. 11. 44).

Susruta has also a similar classification, but he adds another class to the above. He classifies diseases into four groups : (1) *traumatic* or of extraneous origin (*āgantuka*) ; (2) *bodily* (*sārīra*) ; (3) *mental* (*mānasa*) ; and (4) *natural* (*svabhāvika*). A disease due to an extraneous blow or hurt is called *āgantuka*. Diseases due to irregularities in food or drink or incidental to a deranged state of the blood or of the bodily *doṣas* acting either singly or in concert, are called *sārīra*. Excessive anger, grief, fear, joy, malice, etc., are included within the category of mental (*mānasa*) distempers. Hunger, thirst, decrepitude, imbecility, death, sleep, etc., are called natural (*svabhāvika*) derangements of the body (S.S. I. 1).

Susruta gives another wider classification of diseases, which incorporates the above. He divides all diseases into three main classes and each class he again sub-divides into smaller groups :—

I. *Ādhyātmika* or physical. This class is divided into three sub-groups :

(1) *Ādi-bala-pravṛtta*, or hereditary diseases which owe their origin to diseased semen or menstrual fluid ; e.g., leprosy, piles, etc. This group is sub-divided into two : viz., paternal and maternal.

(2) *Janma-bala-pravṛtta* or congenital diseases. These are caused either by diseased *rasa* or by neglect on the part of the mother to satisfy her longings during pregnancy : e.g., lameness, blindness, deafness, nasal voice, dwarfishness, etc.

(3) *Doṣa-bala-pravṛtta* or diseases caused directly by derangement of one or more of the *doṣas*, or by improper diet, or unhealthy habits or by one disease producing another. This group is sub-divided into two : bodily, produced by the *doṣas*, *vāyu*, *pitta* and *kapha*, and mental, produced by the mental *doṣas*, *rajas* and *tamas*. The former is again sub-divided into two : viz., diseases originating from disordered *doṣas* of the *āmāsaya* and those originating in the *pakvāsaya* or the intestines.

II. *Ādhibautika*, i.e., diseases caused by disturbances in the physical environment of man. These are called *saṃghāta-bala-pravṛtta* and are due to external causes. They are of two kinds : those caused by weapons and those caused by wild animals.

III. *Ādhidaivika* or diseases due to acts of God or Nature. This class is divided into three sub-groups :

(1) *Kāla-bala-pravṛtta* or seasonal type. These are produced by the successive changes of the six seasons in the year, or by any variation in the atmospheric conditions. This type is sub-divided into two, according as the season exhibits its normal features or the contrary.

(2) *Daiva-bala-pravṛtta* or the providential type : these are caused by a curse or divine wrath or brought about by mystic charms or spells. This type is sub-divided into two : those caused by thunder and lightning, and those caused by various spirits.

(3) *Svabhāva-bala-pravṛtta* or the natural type. These are the results of natural processes, such as, hunger, thirst, old age, death, etc. This type is sub-divided into two, timely and untimely. Those caused by the influence of time, notwithstanding due care of health, come under the former class, and those caused untimely, from want of due care, under the latter (S.S. 1. 24).

Charaka classifies diseases into two groups, according to differences of origin or nature, curable and incurable (C.S. III. 6. 1). Curable diseases are of two kinds, those that are easily curable and those which are curable with difficulty. Incurable diseases also are of two kinds, those that are capable of being suppressed, and those that have no treatment (C.S. I. 10. 3). Susruta divides diseases into three kinds according to their grade of seriousness : curable (*sāhya*), capable of mitigation (*yāpya*) and incurable (*asāhya*) (S.S. 1. 35). This classification is always adhered to in the description of diseases. Chronic diseases are understood by *yāpya* ; these may be temporarily checked by suitable medicines or remedies but cannot be cured. In Charaka's classification they form a section of incurable diseases.

Charaka gives another classification based on the seats of the diseases, which are three : *sākha*, vital parts and bone joints, and *koṣṭha*. Among these, *sākha* includes blood and the like, the constituents known by the name of *dhātu* and skin. These constitute the *external seat of disease*. The vital parts are the arms, the heart, the brain and the like. The bone joints are the joints of different bones and the arteries and veins attached to them. These constitute the *second seat of disease*. *Koṣṭha* is the cavity containing undigested food, the cavity where digestion takes place. This constitutes the internal or *third seat of disease* (C.S. I. 11. 47).

PATHOLOGY

Charaka defines disease as *dhātu-vaiṣamya* or disharmony of the *dhātus*; and *dhātu-vaiṣamya* as the increase or decrease of some of the *dhātus*. It has to be noted that not every kind of excess or deficiency of the *dhātus* produces *dhātu-vaiṣamya*, or disequilibrium of the *dhātus*: it is only when such deficiency or excess produces affections of the body that it is so called. Slight variations of the due proportion of *dhātus* cannot be called instances of *dhātu-vaiṣamya* unless accompanied by *vikāra* or external symptoms.

The *dhātus* do not increase or decrease in their normal measure spontaneously. There must be some cause or causes for this disturbance of their equilibrium. These causes are called *nidānas*. We have discussed them in the previous section. There are three things necessary, says Charaka, for the production of a disease: *nidānas* or causes which vitiate the *doṣas*, *doṣas* or vitiators, and *dūṣyas* or the constituents of the body (*dhātus*) which are vitiated. When the *nidānas*, the *doṣas*, and the *dūṣyas* are mutually connected together there is production of a disease; when the connection is not thorough or complete or the causes are weak, there is production of a disease of mild type, not all the symptoms being manifest (C.S. II. 4. 4). The *nidānas* cannot produce disease by themselves acting directly on the *dhātus* but must act on the *doṣas* and vitiate them first, after which the vitiated *doṣas* in their turn act on the *dhātus* or the *dūṣyas* and produce disease in them.

The *doṣas* of the body, *vāta*, *pitta* and *kapha*, when acted upon by their respective *nidānas* or predisposing causes, may either retain normal measure or decrease or increase or be aggravated. Particular symptoms are manifested when a *doṣa* is thus acted upon.

The waste of the bodily *vāyu* is followed by a state of languor, uneasiness and loss of consciousness. Excess of *vāyu* is marked by roughness of the voice, thinness of the body, darker complexion, desire for heat, throbbing sensation, hard stool, insomnia and weakness. Aggravated and expanded *vāyu* tends to deviate from the right path and normal direction and gives rise to a swelling or distension of the abdomen, accompanied by a rumbling sound in the intestines.

The waste, or deficiency of *pitta* is marked by dullness of complexion and diminution of body-heat. Excess of *pitta* is marked by a burning sensation of the body, desire for coolness, yellowish skin, eyes, faeces and urine, insufficient sleep, fainting

fits and weakness of the sense organs. *Aggravated and expanded pitta* would give rise to heat.

The waste of bodily kapha is marked by dryness, sensation of internal burning, a feeling of emptiness in the stomach and other cavities of the body, looseness of the joints, thirst, weakness and insomnia. *Excess of kapha* is characterised by whiteness of complexion, heaviness of the limbs, a feeling of coldness, drowsiness, excessive sleep and looseness of the joints. *Aggravated and expanded kapha* would produce a complete aversion to food, inertness of the limbs, vomiting and impaired digestion. Not only the *doṣas* of the body but the *dhātus* also undergo decrease, increase or vitiation when acted upon by their respective *nidānas*. The decrease of the *dhātus* is brought about by the abuse of alternative and depurative medicines, by restraining the natural inclinations to pass urine or faeces, by the use of unwholesome food, by mental anxiety, excessive exercise, fasting and excessive venery.

In decrease of rasa or chyle, there is thirst, palpitation and pain, and a sense of emptiness in the heart. *In decrease of blood*, there is roughness of the skin, desire for acid and cooling things, and relaxation of the veins. *In decrease of muscle*, the buttocks, cheeks, lips, genitals, thighs, breasts, sides of the chest, calves, abdomen and neck are emaciated; there is roughness and pain of the body, and depression and relaxation of the arteries. *In decrease of fat* the spleen enlarges, the joints feel empty; there is roughness of the body and desire for fat meat. *In decrease of bone*, there is pain in the bones, cracking of the teeth and nails, roughness of the body. *In decrease of marrow*, there is diminution of semen, pain in the joints and bones, and a sense of emptiness in the bones. *In the decrease of semen*, there is pain in the penis and testicles, and impotence or delay in the emission of semen. The semen discharged is mixed with blood. *In decrease of faeces*, there is pain in the heart and sides, wind passes upwards with noise and moves about within the abdomen. *In decrease of urine*, there is pain in the bladder and scanty urine. *In decrease of perspiration*, the skin is dry and does not perspire, its pores are closed, and its sensibility is impaired. *In decrease of menstrual blood*, the menses do not appear at the proper time or are scanty, and there is pain in the genitals. *In decrease of milk*, the breasts are reduced in size and secrete less milk. *In decrease of foetus*, the abdomen does not enlarge and quickening is not experienced.

The increase of the doṣa, essential parts (*dhātus*) and excretions (*malas*) is caused by the use of such regimen and articles

of diet as have a natural tendency this way. When *rasa* is increased, there is nausea and salivation. When *blood* is increased, the body and eyes become red and the veins full. When the *muscles* are increased, there is increase in the size of the buttocks, cheeks, lips, genitals, thighs, arms and legs, and heaviness of the body. When the *fat* is increased, there is increase in the size of the abdomen and sides, cough, difficulty of breathing, etc., the skin is unctuous and emits a bad smell. When *bone* is increased, the bones are hypertrophied and additional teeth are developed. When the *marrow* is increased, there is a sense of weight in the entire body as also in the eyes. When the *semen* is increased, calculi formed of semen are produced in the bladder, and there is excessive discharge of this secretion. From increase of the *faeces*, there is pain in the abdomen and borborygma. When the *urine* is much increased, there is frequent micturition, pain in the pelvis and distension of the abdomen. From increase of *perspiration*, there is bad smell and itching of the skin. From increase of *menses* there is pain in the body and limbs, excessive menstruation and debility. When the *milk* is increased, the breasts enlarge and become painful, and there is frequent discharge of milk from them. When the *foetus* increases much, the womb is enlarged and there is *anasarca*. When a *dhātu* is increased, the next *dhātu* which is nourished by it is also increased, hence all the *dhātus* that are increased should be reduced. (S.S. 1. 15).

The following disorders originate from *diseased rasa*, viz., distaste for food, disinclination for food, indigestion, pain in the limbs, fever, nausea, sense of satiety, sense of weight, diseases of the heart, jaundice, obstruction to the outlets of the body, emaciation, bad taste in the mouth, lassitude and premature wrinkling of the skin, appearance of grey hair, etc.

The following disorders originate from *disordered blood*: skin diseases, erysipelas, boils, warts, black spots on the face, moles, chloasma, brown spots on the face, baldness, spleen, deep-seated or internal abscesses, abdominal tumours, leprosy, piles, tumours, menorrhagia, haemorrhages from internal organs, and suppuration in the anus, mouth and penis.

The following disorders are caused by *diseased muscles*: swelling round the wisdom tooth, tumours, piles, inflammation of the root of the tongue, ranula, inflammation of the gum, enlarged tonsils, a sort of eruption which appears in diabetes called *alaji*, painless tumour of the palate, inflammation of the lips, goitre, enlarged glands of the neck, etc.

The following disorders originate in *diseased fat*: enlarged

glands, hydrocele, bronchocele, tumours, corpulence, swelling of the lips, diabetes, excessive obesity, excessive perspiration, etc.

The following diseases originate from *diseased bones* : enlarged bones, additional teeth, pain in the bones, thickening and psoriasis of nails, etc.

The following disorders originate from *diseased marrow* : impaired vision, fainting, delirium, sense of weight in the joints, thickening of the thighs and legs, discharge from the eyes.

The following diseases arise from *diseased semen* : impotence, disinclination for sexual intercourse, calculus from the semen, discharge of semen in the urine and other diseased states of the semen.

When the *large intestines* (or the seat of faeces) are diseased, there then ensue disorders of the skin, costiveness or diarrhoea.

When the *seats of the senses* are diseased, then the senses are either incapable of performing their functions or they are very sensitive. (S.S. 1. 15).

Susruta describes in detail the various steps through which the *doṣas* pass in the course of production of disease.

(i) The first stage (*caya*) is the stage of accumulation of the *doṣas*. During this stage the *doṣas* collect in their respective places or sites.

(ii) The second stage is the stage of *prakopa* or excitation. After accumulation, as a result of the action of their respective *nidānas* and lack of treatment, they become excited and, leaving their normal site, they spread.

(iii) The third stage is called *prasāra*. At this stage there is something like a fermentation of the *doṣas*. This is moved about by *vāyu*, which is the cause of all motor activities. As a result, the *doṣas* flow, sometimes alone, sometimes two conjointly, and sometimes all together. In the whole body, in half of it, or in whatever part the fermented *doṣas* spread, there the symptoms of diseases are showered down as it were, like water from the clouds.

(iv) This stage is called the *pūrva-rūpa* or the stage of premonitory symptoms. During this stage the *doṣas* get localised in different parts of the body (*sthāna-samshraya*). They produce diseases after reaching different parts according to the nature of the structures contained in these parts.

(v) The fifth stage is the stage of *rūpa* or the fully fledged disease. This is the stage of appearance or development of the disease. Such diseases as inflammatory swellings, enlarged glands, large abscesses, erysipelas, fever, diarrhoea, are produced, which are readily diagnosed by their symptoms.

(vi) The sixth stage is one in which a disease opens out a part of the body and forms sores.

THE PLACES OF LODGEMENT OF DERANGED *Doṣas* AND THE DISEASES THEY PRODUCE : When they enter the *abdomen*, they cause tumours, deep-seated abscesses, loss of digestive fire, flatulence, cholera, diarrhoea, etc. When they reach the *pelvis*, they cause urinary disorders, calculus, suppression of urine, deranged urine, etc. When they reach the *penis*, they cause stricture of the urethra, chancres, a peculiar form of sore called *sukadosha*, etc. When they reach the *anus*, they cause fistula-in-ano, piles, etc. In the *scrotum*, they cause scrotal tumours. When they reach the *parts above the clavicles*, they cause disorders of the organs situated above them. When they enter the *skin, flesh and blood*, they cause the minor diseases, skin diseases, erysipelas, etc. When they enter the *fat*, they give rise to enlarged glands, tumours, bronchocele and *alagi* (an eye disease), etc. When they enter the *bones*, they cause deep-seated abscesses, pustules on the feet, etc. In the *feet* they cause elephantiasis, leprosy, swelling of the ankle, etc. When they spread *throughout the body*, they cause fever and diseases which affect the whole body. The deranged *doṣas* pervade the body, and where from their contact any tissue becomes affected, there a disease is set up.

Susruta's description of the various stages in the development of a disease is that of a surgeon. From the point of view of surgery, *sthāna samshraya* or taking up of another location is all that is required to explain surgical diseases. During the stage of *sthāna samshraya*, the excited *doṣa*, having extended to another part, becomes located there, causing specific diseases of these structures, i.e., diseases of blood, stomach, bladder, etc. Diseases assume various forms owing to the different modes in which the *doṣas*, the *dhātus*, and the *malas* are mixed up in a particular case, the different parts of the body in which they are deranged and the causes by which the disorders are induced. When the fifth stage, i.e., the stage of established *doṣas*, and the sixth stage, i.e., the stage at which the disease opens out a part of the body and forms a sore, are reached, we have fully-fledged surgical diseases. Thus, Susruta's description amounts to surgical pathology.

Charaka, in *Vimāna Sthāna*, Chapter V, enunciates a theory of the pathogenesis of diseases which does not occur in other medical classics. This view is quite original and historically it is of great interest, as a similar view was put forward by the Egyptians in the second millennium B.C. "Whatever embodied phenomena occur in a person, are all only special forms (or

conditions) of the ducts. No phenomena (visible) in a person ever make their appearance or ever disappear (subside) without (the action of the) ducts." *If the ducts are in their normal state, the body cannot be affected by any disease.* Verily, those symptoms which indicate the vitiation of the *dhātus* (constituent ingredients of the body) are indications of the (vitiation of the) ducts (themselves) that bear those *dhātus*. In consequence of the excitement of the ducts, the constituent elements of the body, which dwell and pass through them, become themselves excited. In consequence of the excitement of the other ducts, the other elements (passing through them) become excited. After the same manner the ducts that become vitiated vitiate other constituents (of the body). Of all those ducts and constituent elements vitiated, *vāyu*, *pitta* and *kapha* become vitiators in consequence of their very nature as *doṣas*. What exactly is meant by vitiation or excitement is not clear. Charaka gives the *nidānas* which bring about the vitiation of each of the ducts. Then he discusses the method of allaying the irritation caused in the ducts. The same view was held by the Egyptians about the ducts of the body and their role in diseases. In the Egyptian papyri the term used for the ducts is *metu*. They held that abnormal conditions of the *metu* caused diseases. The *metu* were believed to take in disease and to carry it to certain parts of the body. Treating the *metu* was aetiological therapy. Papyrus Hearst contains a number of very important prescriptions for its treatment. The purpose was to soothe the *metu* when irritated.¹

Charaka in the *Nidāna-sthāna*, in describing the pathology of diseases, adheres very rigidly to the view enunciated by him that a disease results only when *nidānas*, *doṣas* and *dhātus* come in causal connection with one another. So, in the diseases there dealt with, he mentions first the *nidānas*, then the *doṣa* or *doṣas* excited and then the *dhātus* or *dūṣyas* vitiated in each disease. Though Susruta describes how diseases are produced by the lodgement of a *doṣa* or *doṣas* in the *dhātus* of the body, he does not say what it is that makes a *doṣa* take up its position in a particular *dhātu* or *dhātus*. The reason for this predilection is supposed to be the similarity between the *doṣa* and the *dhātu* affected, with regard to their characteristics and the *nidānas* which bring about the excitement of the *doṣa*. But Charaka puts forward the view that the localisation of a *doṣa* or *doṣas* in a particular *dhātu* or *dhātus* is not accidental but in each disease certain *dhātus* are more prone to be involved and so in each of the eight diseases he specified the *dhātus* picked out. Susruta does not explain the mechanism of the production of the

symptoms though after the symptoms are manifest, they are assigned by similarity to a particular *doṣa* or *doṣas*. But Charaka tries to give an explanation of the production of the symptoms. For this he utilises his theory of the ducts and their role in the production of disease. We have seen in Chapter I that he considers *dhamanīs*, *sirās* and *srotas* ducts for the carriage of the products of metabolism and he uses 'ducts' in the sense of *srotas* in this discussion. He puts forward a mechanical theory of the production of symptoms. *Vāyu* plays the leading role in this. It produces an obstruction of the duct involved, as a result of which the symptoms follow. He thus explains the pathogenesis of fever. When *vāyu* becomes excited, it enters the *āmāsaya* and there it becomes mingled with the digestive fire. Overtaking in that state the food-juice (*rasa*), it obstructs those ducts which carry this and the sweat. It then affects the digestive fire and, expelling the heat from the *pakvāsaya*, causes it to spread over the whole body. It is then that fever is generated.

He explains the production of *gulmas* (abdominal tumours) in the same way. The excited *vāyu* enters the principal ducts. In consequence of its dryness, it becomes hard and, having blocked the great ducts, it remains in a globular and condensed form in them. It then generates *sūla* or pain in the thorax, the rectum, the sides and the navel.

He explains the different varieties of *prameha* or urinary affections, on the same basis of obstruction of the ducts. Different *doṣas* are involved in the various kinds of *prameha*. In *kapha*-born *prameha*, the *doṣa* particularly excited is the *kapha*. The *dūṣyas* or the *dhātus* which produce this disease are accumulated fat or flesh, and *malas*, urine, etc. The excited *kapha*, in its turn vitiates these *dūṣyas*. Acted upon by the fat and the *malas* the excited *kapha*, coming at the mouths of the urine-bearing ducts of the pubic region and the anal canal, obstructs them completely. The *malas* of the body, united with *kapha* and fat, enter the kidney, are transformed into urine and become affected by these ten abnormal attributes of *kapha*: white, cold, hard, slimy, limpid, oily, heavy, sweet, condensed and partially condensed and partially liquid. It then receives a distinctive appellation, which is essentially qualitative, according as it is decidedly affected by one or more of the above qualities.

Describing the *nidāna* of phthisis, Charaka explains how food consisting of inharmonious ingredients causes *phthisis*. When a man takes such articles of food and drink as do not harmonise with his system, the *doṣas* of his system are vitiated. When these, declining from their normal condition, spread over the

whole body and obstruct the mouths of the ducts, then whatever food the person takes results in the production of excessive stools and urine. The food is not turned into any other *dhātu* or ingredient of the body.

Discussing the *nidāna* of insanity he explains its production as follows : The wind being afflicted and the understanding disturbed, the faults are aggravated and provoked ; then, reaching the heart and *obstructing the ducts through which the mind operates*, they beget insanity.

CHAPTER V

DIAGNOSIS AND PROGNOSIS

DIAGNOSIS

Diagnosis was the greatest achievement of ancient Indian medicine. Charaka lays very great emphasis on correct diagnosis as the basis of any rational treatment. He devotes three complete *sthānas*, the *Nidāna*, *Vimāna* and *Indrya*, in his *samhita* to an exhaustive discussion of the subjects of diagnosis and prognosis. Chapter 8 of the *Vimāna Sthāna* is perhaps the most comprehensive and complete discussion of the subject of diagnosis we possess in any ancient medical literature, including the Hippocratic collection. "The physician conversant with his science, reflecting, in all manner of ways, upon everything, as far as is possible, should then come to a conclusion about the diagnosis of the disease before him and the treatment that should be followed. The physician of knowledge who fails to enter the inner body of the patient with the lamp of knowledge and understanding can never treat diseases." (C.S. III. 4. 13 & 15).

The physician who sets himself to treat a disease should, before commencing his operations, examine by the usual methods of examination, the ten elements which deserve to be examined and then begin his treatment. The ten elements are:—(1) *kāraṇa* (the agent or the mover); (2) *kaṛaṇa* (the instrument necessary for an agent to bring about an effort); (3) *kārya-yoni* (the material cause by the modification of which effects are produced); (4) *kārya* (that for the production of which the mover makes his effort); (5) *kārya-phala* (that for which a particular effect is intended by the agent); (6) *anubandha* (the good or bad result which attaches to the doer after the production of the effect); (7) *desa* (place); (8) *kāla* (the season, days, etc.); (9) *Pravṛtti* (the effort and action needed for the production of the effect); (10) *upāya* (the passivity and special aptitude of the agent, the instrument and the material cause which can make the effect possible).

The physician is the cause (*kāraṇa*), the medicines and instruments (*kaṛaṇa*); the want of equilibrium of the *dhātus* (*kārya-yoni*); the restoration of their equilibrium (*kārya*); the happy state

of the body and mind (*kārya-phala*) ; length of life (*anubandha*) ; the place and the diseased person (*desa*) ; the year and the condition of the diseased person (*kāla*) ; the efforts of the physician (*pravṛtti*) ; the qualifications of the physician, the qualities of the medicine, etc. (*upāya*). From the point of view of diagnosis the subjects of interest are the *kārya-yoni*, *desa* and time.

Kārya-yoni is the want of harmony among the *dhātus* (the constituent elements of the body). Its indication is the accession of an abnormal condition of the *dhātus*. Its examination consists in an observation of the symptoms that indicate an increase or decrease of the *dhātus*. The examination of the abnormality also consists in an observation of such symptoms as indicate curability or incurability, mildness or virulence.

Desa or the field of action includes both the country or habitat of the patient and the patient himself. The following points have to be ascertained with regard to the country to which the patient belongs : where was the patient born, where did he grow up and where did he contract the disease. In the country where he was born, what are the articles of food and drink, what are the sports, what are the practices, what the measure of strength, what is the sort of constitution, what are the practices suitable to health and life, what are the faults that predominate in the constitutions, what are the inclinations, what the ailments of the people and what is beneficial and what injurious to them. From a knowledge of the soil from which the medicines are obtained, an idea of the medicines may be formed.

Great emphasis was laid on the examination of the patient. This examination of the patient has, really, one object in view, ascertainment of the period of time for which the patient may yet live. This is dependent on ascertainment of the measure of his strength, including the measure to which the *doṣas* have been excited. For the ascertainment of the strength of the patient information on the following ten items is needed :—(1) his normal constitution in health ; (2) the abnormal constitution that has set in ; (3) the predominance of the particular element or essence (*sāra*) in his constitution ; (4) his compactness or otherwise ; (5) his proportions such as stature, etc. ; (6) what things are suitable to his constitution ; (7) his mental disposition ; (8) his power of assimilation ; (9) his power of exercise ; (10) his age. The diagnosis of the measure of the vitiation of the *doṣas* is discussed later.

A healthy constitution is one in which *vāyu*, *pitta* and *kapha* are in harmonious proportions. Any one of these *doṣas* may

predominate in a constitution and thus we may have a *vātala*, *pittala* or *śleṣmala* constitution. A knowledge of the constitution is important as the effect of food and seasons vary in different constitutions.

There are eight *sāras* (predominating essences or elements) in the body, mind, semen, marrow, bones, fat, muscle, blood and skin. Memory, veneration, wisdom, valour, purity, and devotion to useful works are the results of *satwa* (the mind). Lustre of the body and firmness and white colour of the bones, teeth, and nails and sexual desire are due to the essence (*sāra*) of semen. Plumpness, strength, splendour of the body, depth and softness of voice and largeness of the eyes are due to the essence (*sāra*) of marrow. Large head and shoulders, firm teeth, jaws, bones and nails are due to the essence (*sāra*) of bones. Cool urine and perspiration, soft voice, large body and capacity to bear hardships are due to the essence (*sāra*) of fat. A body without openings or cracks in it, deep-seated bones and joints and muscular build are due to the essence (*sāra*) of muscle. Smooth copper-coloured nails, eyes, palate, tongue, palms and soles are due to the essence (*sāra*) of blood. The lustre and softness of the skin is due to the essence (*sāra*) of the skin. It has been laid down that a person should be examined by the test of his essence (*sāra*). This prevents a physician from arriving at an erroneous conclusion by a sight of the body alone of the patient. Such conclusions should never be formed as that one is endowed with strength because his body is large or another is of little strength because his body is lean, etc. It is indeed seen that men whose bodies are of small dimensions or are lean are still possessed of strength.

As regards examination of the patient by observation of his body, that body can be called firm or compact which consists of symmetrical and well-formed bones, well-knit joints, and well-placed flesh and blood. Those men who are possessed of firm and compact bodies are endowed with strength.

As regards examination of the patient's dimensions, certain standards are laid down in the medical classics. The entire foot is 14 fingers in length, the lower leg 18 fingers, the thigh 32 fingers, the two together being 50 fingers in length. The distance between the penis and the navel, that between the navel and the chest, that between the chest and the throat, and that between the two breasts measure 12 fingers each. The length of the arm from the shoulder to the elbow is 16 fingers. The forearm including the hand measures 24 fingers. The circumference of the chest in females is equal to the circumference of the waist

in males. The breadth of the chest in females is 18 fingers, which is the breadth of the waist in males.. The height of the male is altogether 120 fingers.

The male and female attain their full development at the ages of 25 and 16 respectively. If their bodies measured by their own fingers at these ages correspond with the measurements given above they attain long life and riches. If the measurements are of moderate length their lives and riches will be moderate, and if very short, then their lives will be short.

Examination of the patient in respect of capacity for food is to take into account the capacity both for eating and for digestion. Strength and longevity are both dependent on food.

Examination of the patient in respect of capacity for exertion is to take into account his capacity for action, for bearing weights and for the length of time he can perform physical labour.

Examination with regard to time : Time is of two kinds, the year and its division into various seasons and the age of the patient. A knowledge of the seasons is of special importance in connection with the administration of medicines and correctives. The age of the patient is of value in ascertaining his life expectancy (C.S. III. 8).

By the above examinations an idea is obtained as to the strength of the patient and from this a fair estimate of his expectation of life can be made. Strength is generally described as of three grades, strong, middling and weak. This classification gives some indication towards assessing his life expectancy.

The methods of diagnosis. There are three special methods (*pramānas*) of diagnosis :—(1) the instructions of the inspired or wise (*āptopadesa*) ; (2) observation (*pratyakṣa*) ; (3) inference (*anumāna*). One should first fully examine a disease by means of these three. The diagnosis that is thus accomplished is faultless. Among these three means of knowledge, that derived from the instruction of the inspired comes first (C.S. III. 4. 2).

1. The instruction of the inspired or wise (*āptopadesa*). Āyurveda admits verbal testimony as an independent *pramāna*. It does not restrict this to the Vedas only but extends it also to secular writings, defining it in general terms as the testimony of a trustworthy person (*āpta*), who knows the truth and communicates it correctly. Writing about the instructions of the inspired or wise, Charaka says : “ they are called inspired who are conversant with all distinctions, without the help of reasoning and memory, and who behold all things without joy and sorrow. In consequence of their being endowed with such

merits, the words they utter are authoritative." (C.S. III. 4. 3). Susruta says of the authority of the s̥āstras "wise men, without enquiring for reasons, will act according to the dictates of the s̥āstras." (S.S. I. 40).

These are the points regarding which those that are possessed of intelligence lay down instructions. "Diseases individually are such and such; the strength of the disease is so and so; this is the seat of the disease; the origin of the disease is so and so; this is the soul of the disease; this is the manner in which the disease makes itself known; these are the sound, touch, colour, taste, and smell pertaining to the disease; these are the aggravations; this is the evenness (usual state) and this is the attenuation of this disease; this is the development of the disease; this is the name by which this disease should be known; in this disease for its treatment this should be done or this should be abstained from."

2. Observation (*pratyakṣa*). Charaka says: "One desirous of ascertaining the truth about the disease with the aid of observation should examine, with all his senses, all objects of the senses occurring in the body of the patient, except taste which can be ascertained otherwise." The Indian physician employed not only inspection, palpation and auscultation, but even pressed the sense of taste and smell into the service of diagnosis. With the eye were perceived increase or decrease of body weight, the appearance of the skin, of the tongue, of the excretions, the shape and size of swellings. With the ear, attention was paid to alterations in voice, to the sound of breathing, cracking of the joints, crepitations of broken bones and rumbling of the bowels. With the sense of touch, were perceived the temperature, smoothness and roughness, hardness and softness of the skin. Taste gave information upon the state of the urine (sweet taste in diabetes), and smell gave information upon the nature of exhalations. Charaka prefers ascertaining taste by indirect methods such as by observing the movements of bees, the sweetness of the body and by observing the movement of lice, the foetidness of the same.

Susruta lays particular stress upon the interrogation of the patient in the ascertainment of certain facts about the disease: the time or season of its first appearance; the caste to which the patient belongs; things or measures which tend to bring about a manifest amelioration or prove comfortable to the patient (*sātmya*), as well as the cause of the disease; the aggravation of pain; the strength of the patient; his state of digestion and appetite; the emission of stool, urine and flatus or their

stoppage ; and maturity of the disease in regard to time. Charaka adds to this list the dreams of the patient.

3. Inference (*anumāna*). Inference plays a great part in diagnosis. The two principal kinds in practical use were the inference from cause to effect and that from effect to cause. Charaka mentions a third kind, inference of disease from its early prognostications (*pūrva-rūpa*). Thus if it is known that overfeeding leads to indigestion and that a person has indulged in a heavy meal, then with the first symptoms of uneasiness one may at once infer that the patient is likely to have diarrhoea. Here from the premonitory symptom of diarrhoea, uneasiness, the cause is inferred. The prognostication may, however, be of the nature of an immediately and invariably associated antecedent, which may cease altogether when disease shows itself. Thus before a high fever the hair of the patient may stand erect ; but this is neither the cause of the fever nor is it co-existent with it, since it may vanish when the fever actually manifests itself. It is, however, so invariably associated with a specific kind of fever, that the fever can be inferred from it. Again, when there is any doubt as to which of a number of causes may be the real one, the physician has to employ the method of difference or of concomitant variation in order to find out. That similar things produce similar effects and opposite things opposite effects are two of the accepted postulates of the law of *sāmānya* and *viśeṣa*. Now applying these two principles, it is held that if the application of any particular kind of element increases an effect (a particular kind of disease) and the application of its opposite decreases it, then that particular element may be regarded as the cause of the effect. Charaka holds that the three methods, viz., the cause-effect relation (*nidāna*), the method of invariable prognostication (*pūrva-rūpa*), and the method of concomitant variation (*upasaya*, which includes also *anupasaya*) are to be employed either jointly or separately for the diagnosis of diseases which have already occurred or which are going to occur in the near future.

Diagnosis is to be based, says Charaka, on *nidāna* (causes), *pūrva-rūpa* (premonitory indications), *rūpa* (symptoms), *upasaya* (administration of drugs and diet), and *samprāpti* (fullness or development). *Nidānas* are the causes which excite the *doṣas* and induce disease ; *pūrva-rūpa* implies those indications which manifest themselves before the appearance of the disease ; *rūpa* are those symptoms which manifest themselves on the appearance of the disease ; *upasaya* is the prescription, followed by relief or recovery, of medicines, diet, and practices that are contrary to the conjectured causes of the disease or to the disease itself as

tentatively diagnosed or to both ; *samprāpti* is the full development of the disease through the action, local or extending over the whole body, of the excited fault (*doṣa*) or faults (*doṣas*) which constitute the immediate *nidāna* of that disease. *Samprāpti* is distinguished by considerations of *samkhyā* (number or enumeration), *pradhānya* (predominance), *vidhi* (kind), *vikalpa* (solution of doubt), *bala* (strength), and *kāla* (time) (C.S. II. 1. 5 & 6).

The first problem for diagnosis is the presence of *dhātu-vaiṣamyā*, that is the increase or decrease of some of the *dhātus*, i.e., the seven *dhātus*, the *doṣas* and the *malas*. Charaka and Susruta give in detail the causes, signs and symptoms of the decrease, increase and vitiation of each *dhātu*, *doṣa* and *mala*. These have already been enumerated in the section on pathology. From these symptoms these states are diagnosed.

The next problem is the stage of *dhātu-vaiṣamyā*. We have seen that Susruta enumerates five stages in its development — *chaya*, *prakopa*, *prasāra*, *pūrva-rūpa* and *rūpa*. The disease has to be diagnosed in all these stages. This is done by the recognition of the distinctive symptoms that are characteristic of each stage. When the *doṣas* accumulate in the stage of *chaya*, they produce dullness and fullness of the hollow viscera, bilious complexion, coldness of the limbs, sense of weight in the body, disinclination for exertion and aversion to the causes which have produced the accumulation of the *doṣas*. When the deranged *doṣas* spread through the body in the stage of *prasāra*, they produce distinctive symptoms.

When *vāta* is deranged, it goes the wrong way and causes gurgling in the bowels. When *pitta* is deranged, it causes burning pain, a dry sensation, a sense of heat in the body and eructation of hot wind. When *kapha* is deranged, it causes disinclination for food, indigestion, lassitude and vomiting. These two sets of symptoms help us to diagnose the disease in the *pūrva-rūpa* stage, both general and special.

When the disease manifests itself in its fullness we have the *rūpa* stage. This stage is diagnosed entirely by its symptomatology. Charaka and Susruta enumerate the symptoms by means of which one can diagnose diseases produced by *vāta*, *pitta* and *kapha*. These symptoms have been mentioned under the *tri-doṣa* theory in Chapter III.

The diagnosis of those diseases which are produced by the excitement of one *doṣa* alone poses no difficult problems. Charaka, writing about *rasas* (tastes) and faults (*doṣas*) and their combinations, remarks "for the sake of expediency only it is laid down

that tastes as unconnected with one another are six and that the faults as unconnected with one another are three." *Doṣas* are rarely if ever excited singly. They are always excited in combinations of one or more, and besides there are different grades of excitement for each of them. "Generally of the faults dwelling in the body, in consequence of their belonging to the same place, there happens a commingling of all or a mingling of any two." In this combination of *doṣas*, one is the principal and the other accessory. That is called the principal which exists independently, whose indications are all manifest and whose origin and alleviation conform to its *nidānas*. That which is endowed with characteristics of an opposite kind is called the accessory. Then if faults exist together with the characteristics of principal and accessory, the co-existence of all three is called *sannipāta*, whilst that of any two is called *samsarga*. The distinctions that are due to the kinds of co-existence as principal and accessory are manifold." (C.S. III. 6. 11-13). Besides the *doṣas* may vary in their individual strengths. The strength is generally described as of three grades, weak, medium and strong. Thus in any disease the *doṣas* co-exist in different combinations and strengths. Charaka gives a count of 16 possible combinations.

This co-existence in number and strength of the *doṣas* poses many problems for diagnosis, which are enumerated under the heading *samprāpti*. From the multiplicity of symptoms presented by the disease, the physician is called upon to diagnose what variety of disease it is, *nija* or *agantu* (*vidhi*), whether it is due to the co-existence of one, two or more *doṣas* and if so what particular *doṣa* is more excited than the other or others and what also is the degree or intensity of the excitement, i.e., its *vikalpa*, which is the principal *doṣa* excited, i.e., *pradhāna*, the strength of the disease and the special seasons or hours which favour the excitement of the faults (*doṣas*), which induced the disease. When these several factors are ascertained the diagnosis is complete. It is claimed that this complete diagnosis can be achieved by a study of the symptoms presented by the disease.

The faults of the system, *vāta*, *pitta* and *kapha*, when excited and strengthened, put forth their respective indications according to their respective strength or force. When on the other hand they become attenuated, a disappearance takes place of their respective indications, commensurate with the degree of attenuation. When all of them exist together in their normal state, each puts forth its own indications equally with the other two. (C.S. I. 16. 61). Thus by noting the symptoms of the disease and

their resemblance to the qualities of the respective *doṣas* the symptoms of the combinations can be arrived at.

After having diagnosed a disease, the next thing to be done is to ascertain whether it is a primary or independent one or merely an accessory or sympathetic one or the premonitory indication of an incipient one. *Aupasargika* (sympathetic) disease is merely a symptom developed in the course of an original disease and which has its foundations in the nature or component factors of the pre-existing disease. A disease which manifests itself from the very commencement of a case and is neither an accessory symptom nor a premonitory indication of some other disease is called a *prak-kevalam* (primary or original one). A disease which indicates the advent of a future or impending disease is called a *pūrva-rūpam* (premonitory stage or indication of a disease). It should be noted that each of the so-called diseases of Indian medicine was nothing but a vague symptom-complex which, upon the slightest deviation from its supposed type, dissolved, to reappear in a number of fresh categories. Thus Charaka remarks: "It is seen that a particular disease operates as the *nidāna* or cause of another disease. Thus from excessive heat of fever arises blood-bile, and from blood-bile springs fever and from these two springs consumption. From enlarged spleen arises abdominal dropsy and from this swellings in other parts of the body. These diseases at first remain as principal ones. They then become causes of other diseases. It is seen that when they become causes of other diseases they retain their individuality while bringing about others. Sometimes, however, they merge into the maladies they bring about so completely as to lose their individuality. Sometimes a particular disease, becoming the cause of another disease, disappears completely. A disease again may also not disappear after bringing about another whose cause it becomes. Thus diverse complicated diseases that are very painful are seen to afflict human beings in consequence of improper treatment, as also of particular diseases being the cause of others. One disease may be the cause of many or of one, or many may be the cause of one, or many the cause of many. Thus from one cause, dryness, may spring fever, vertigo, delirium and other diseases; also from one cause, dryness, may spring only one disease, fever. Also from many causes may spring one disease, as fever from dryness and other causes; so from many causes, dryness and others, may spring many diseases such as fever and others. Sometimes one symptom belongs to many diseases; also one symptom may belong to one disease. Many symptoms again are manifested

by one disease, also many symptoms are manifested by many diseases. The symptoms of several diseases that have been mentioned for a right ascertainment of the particular disease are themselves so many diseases. But when the main diseases are to be considered they should be taken as symptoms only and not as separate diseases." (C.S. II. 8. 16-40). It is evident, therefore, that there is no absolute difference between a cause and an effect, and that which is a cause may be an effect and that which is an effect may also in turn be a cause.

Charaka thus sums up the whole problem of diagnosis : "Without doubt, having carefully noticed the particulars relating to the inducing causes (*nidāna*), premonitory indications (*pūrvarūpa*), symptoms (*rūpa*), applicability of medicine, diet, course of conduct (*upasaya*), the varieties of diseases (*samkhyā*), the predominance of *vāta*, *pitta* and *kapha* in diseases (*pradhāna*), the class under which the disease falls (*vidhi*), the precise measure in which the faults have been excited (*vikalpa*), strength, and age or season, the physician with concentrated mind, should specially attend to the knowledge (analysis) of the tastes, articles, faults, derangements, medicine, country, season, strength, body, diet, predominance of constituent elements (of the body, such as skin, blood, etc.), assimilation, mind, constitution, and age, because of the dependence of curative operations on a conversance with such analysis of the tastes etc." (C.S. III. 1. 1).

PROGNOSIS

The art of prognosis was most fully developed in Indian medicine as in that of other ancient civilisations. The country where it was cultivated to perfection was Mesopotamia. Neuburger thus describes the art of prognosis as developed in Mesopotamia. "The influence of astrological fatalism upon Babylonian medicine is nowhere more clearly seen than in the prognosis which constituted the summit of their medical knowledge. Traces of the prophet's mantle still clung to the physician and nothing could have shown more clearly than Babylonian medicine where the origin of prognosis is to be looked for, what were the intellectual methods employed in its early development and how the transition from supernatural to medical thought was effected. It must be premised that astrology constituted only part of the general belief in omens. According to this belief, in addition to celestial phenomena, all events of note, encounters, etc., assume the role of portents, affording an insight into future

fate. Particular attention was paid to the appearances and movements of various animals (such as the sudden appearance of an animal in a house, from a gate, meetings with dogs or calves, the manner of lowing of oxen, the flight of birds), to the occurrence of abortion in animals and human beings and to dreams. From all these events conclusions were drawn as to the future. Medicine also served as the handmaid of priestly prophecy, its observations being utilised in predictions (deformities, congenital anomalies). The interest of the priesthood in omens gave in turn an impulse to the collection of a series of observations upon disease, and thus was developed the "clinical history", at first only for the purpose of prophecy, later in order to predict the fate of the patient and the outcome of the complaint. In this sense, the observations made on the patient acquired the value of omens (e.g. the expression of the face, the state of the hair, the behaviour of the blood drawn in blood-letting, the urine, etc.) ; each individual symptom, since the link between the cause and the pathological process was not known, remained a token (of recovery or death), an indication for prognosis, not of diagnosis. Hence the empirical facts of clinical observation stand on the same level as dreams and astrological speculation. The next step by which medical knowledge advanced consisted in the elimination of supernatural elements in the premises upon which the prognosis was founded. In other words, inferences are drawn from those phenomena alone, which experience shows to stand in relation to disease."¹

These observations of Neuburger on the evolution of the ideas about prognosis are of great interest from the point of view of Indian medicine. The discovery of the Indus Valley Civilisation has considerably widened the horizon of Indian medicine and has revealed inter-relationships with other ancient civilisations which were not suspected before. The Indus Valley Civilisation was contemporaneous with the civilisations of Mesopotamia, Egypt and Crete. It was in full flower at the time of Sargon of Agade (in Mesopotamia) whose date is now placed a little before 2300 B.C. The views of Babylonian medicine on prognosis show a very close parallel to those held in ancient India on the same subject. This great and essential similarity must be due to the close relationship that must have existed between the civilisations of the Indus Valley and of Mesopotamia.

The origins of the art of prognosis must be traced to the natural desire of the physician to know with some certainty what would be the outcome of his treatment and the course which the disease he was treating would take. In pre-vedic times,

when the cause of disease was attributed to external agencies, the priest-physician looked to these agencies for some guidance as to the outcome of the disease. But as magic and witchcraft were replaced by empiricism and reason, prognosis assumed a different aspect. It was a common experience that patients died in spite of proper treatment. As Charaka remarks: "There are patients that meet with death notwithstanding the application of treatment in its entirety. Not all patients by obtaining treatment obtain recovery. The reason is that not all diseases are capable of cure." The great problem therefore was to discover what were the factors that influenced the course of treatment for good or ill and how to ascertain them beforehand, i.e., before the treatment was commenced. "Men die", says Susruta, "from their actions in a former life, from improper treatment, and from the uncertainty of human life. When life is about to depart, spirits, ghosts, infernal imps, and demons approach the dying and, from their desire to kill, prevent the action of medicine; hence no treatment is effective with persons whose lives are at an end." (S.S. 1. 31). This is animism in full blast; India, with its particularly trying climate, is haunted by epidemics and infectious diseases and from these conditions results the extreme instability of human life. By an elaborate system of dietetics and regimen of life, Indian medicine teaches one how to keep fit, how to preserve carefully the vitality with which one's organism had been endowed, how to reach old age, how to enjoy a long healthy life. Everything centred round the ascertainment of the vitality with which the organism of an individual was endowed, i.e., the life expectancy. That is why such great emphasis was laid on the ascertainment of the period of life expectancy. The physician on approaching a patient should first test his longevity and see if he has any vitality in him, says Susruta. So also Charaka at the commencement of *Indrya-sthāna* mentions several items that should be examined and attended to by the physician desirous of ascertaining what the patient's life expectancy is.

Charaka in *Indrya-sthāna* deals with the subject of prognosis on the same lines which he employed in the study of diseases. To find out what are the indications for ascertaining the life expectancy, he proposes to conduct this examination by means of direct perception, inference and the instructions of the wise, the same three methods he employed in connection with the study of diseases. Some of the objects of examination do not apply to a particular person. These should be considered by the aid of the instructions of the wise, as also by reason (or inference). Those however that appertain to the person himself should be

ascertained by a careful observation of what is normal and what is abnormal. Deviation from the normal is of three kinds : (1) that which appertains to indications ; (2) that which appertains to what is indicated ; and (3) that which is dependent on accidents or omens. Of these, the first kind are those whose causes are indications actually arising in the body. It should be stated that there are some indications which are inherent in the body, and others which appear or occur on particular occasions, producing abnormal conditions of particular kinds. The second kind are those whose determinants are symptoms bearing on disease. "The third is that which concerns accidents or omens. It is that which physicians regard as determinants of one's life expectancy; notwithstanding they are not indications actually arising in the body. Then, again, inasmuch as these indicate the decrease of the period of life, they are also regarded as equivalent to symptoms of approaching death. The wise declare that these are capable of assisting at the ascertainment of the period ; that is, undisclosed by the first and second kinds of abnormality of life." The approach is purely rational and scientific. The three-fold division of all the incidents and the inclusion of accidents or omens in a rational scheme is noteworthy. The accidents or omens stand on the same level and have the same value as the observations made of the patient. They also are regarded as determinants of life expectancy, notwithstanding the fact of their being not indications arising in the body. Inasmuch as they indicate the decrease of the life expectancy, they are also regarded as equivalent to symptoms of approaching death. Medical policy early demanded guidance as to the probable general course of a disease and its curability or incurability ; also as to the nature of the patient and its probable influence for good or evil upon the treatment. The physician is not too confident of his skill and he is also conscious of the limitations of the healing art. The two main things that have to be known before any treatment is attempted are : what is the life expectancy and whether the disease is curable or not.

The following characteristics indicate long life : large hands, feet, sides, back, nipples, teeth, face, shoulders, forehead, joints, fingers, eyes, and arms ; extended eyebrows, broad space between the breasts, long breath, short legs, penis and neck, deep intellect, low voice and navel, firm breasts, large hairs growing on the ears, the top of the head being behind the median line ; the body commencing to dry from the head downwards after inunction of oil and bathing, the region of the heart being the last to dry. A patient possessing the above characteristics should be known

as long lived and should be treated. (S.S. I. 35). We have already noted the characteristics of an incurable disease.

The life expectancy of a patient is inferred from certain signs and symptoms that are regarded as unmistakable prognostications of death. Any symptom from which the nearness of death is inferred is called an *arīṣṭa*. Various *arīṣṭas* derived from examination of various systems are mentioned. These concern abnormal changes in the physical or mental condition of the patient. Thus, if he seems to hear a noise or confounds various noises with each other, if he gets irritated at the voice of a friend and rejoices at that of an enemy, feels cold as hot and heat as cold, feels burning heat in chilblains, does not feel a blow or even a cut on a limb, thinks he sees the stars and moon by day and the sun at night, if his eyes are remarkably restless or motionless, if brown, red, blue or yellow shadows follow him, if his teeth have become brown or have suddenly fallen out, if his tongue is white, or brown, dry, heavy, numb, coated or rough, his mouth smells badly, his limbs become suddenly heavy or remarkably light, if his veins stand out on his forehead when they did not previously, if his sneezing, cough, etc., sound differently from usual, if strong perspiration occurs without cause, if the patient cannot sleep or sleeps continuously, if his feet and hands are cold, his breathing laboured, etc.; these are all considered ominous signs foretelling death. If any part of the body changes its natural colour, consistency, dimensions, position, like an erect part hanging down or a hanging part becoming erect, if any part of the body suddenly becomes cold, hot, dry, oily, discoloured or enervated, then that part has changed its usual character.

Besides these indications of death, there are some complications arising during the course of certain diseases which are regarded as ominous. Eight diseases were considered to be fatal from want of supporting treatment or in the advent of complications. These are nervous diseases, urinary disorders, certain skin diseases, piles, fistula-in-ano, calculus in the bladder, ascites and malpresentations of the child in labour. Nervous diseases prove fatal when swelling, insensibility, fracture, shivering, tympanitis, and pain intervene; urinary disorders, when secretion of urine becomes copious or the patient is infested with deep-seated boils; piles when complicated with thirst, disinclination for food, abdominal pain, copious discharge of blood, anasarca and diarrhoea; calculus in the bladder when complicated with swelling of the hypogastrium and scrotum, retention of urine, and severe pain; abnormal presentations during labour prove fatal if inflammation of the womb, swelling from collection of blood in the pelvis,

contraction of the vagina, etc., occur ; ascites, if the patient loses his appetite and develops anasarca and diarrhoea, and the abdomen feels full even after purging. Certain symptoms of fatal import are noted. In consumption, heat in the shoulders, hiccup, vomiting of blood, epistaxis, and pain in the sides prove fatal. When a patient complains of great pain in the upper part of the chest while speaking, vomits and is afflicted with deep-seated pain in the region of the chest, treatment is useless. This is suggestive of *angina pectoris*. It is also a bad symptom if a person gets an accession of fever in the afternoon, has a painful cough and is without flesh and strength. This is suggestive of an advanced case of pulmonary tuberculosis. The case is fatal when a man's chest is largely filled with phlegm which is blue, yellow or red in colour and which comes out constantly. This is very suggestive of pulmonary oedema. It is also a bad symptom if a patient feels a cutting pain in his *āmāsaya* (stomach), has great keen thirst, or is afflicted with excruciating pain in the rectum. These conditions are suggestive of a perforated duodenal or gastric ulcer or perforated intestines.

The Indian prognosis displays, on the one side, wonderful perception and power of observation, whilst on the other hand, it literally abounds in evidence of primitive superstition. In this connection may be indicated their belief in dreams and the ominous influence of purely fortuitous occurrences previous to visiting the patient. Great stress was laid on the occurrence of celestial phenomena. Susruta says, "the physician should not be called in the following lunar asterisms : Kṛttika, Ārdra, Asleshā, Maghā, Mūla, Pūrvaphālguni, Pūrvāshada, Pūrvabhādrapada or Bharani and on the following days of the moon : the fourth, sixth, and ninth and the day of the new moon." In addition to celestial phenomena, all events of note, encounters, etc., assume the role of portents, affording an insight into future fate. Susruta says : "The appearance, address, dress and action of the messenger sent to call a physician, the star, hour, and lunar day on which he is called, the birds seen at the time, the residence, speech and mental and bodily actions of the physician, all afford omens from which a favourable or unfavourable prognosis may be formed of the patient's illness."

It was counted as a happy omen if the messenger sent to fetch the physician was clean, dressed in white, of the same caste as the sufferer and came riding in an ox-cart. It was inauspicious if the messenger was of a higher caste, a eunuch or a woman, himself sick or afraid, if he ran, if he wore shabby or dirty clothes, rode on an ass or a buffalo, came at mid-night or mid-

day or at a time of an eclipse of the moon or if he arrived when the physician was asleep or lay unclothed upon the ground.

Good omens were : accidental encounters upon the road with a maiden, a suckling woman, two Brahmins, a running horse, etc.

Bad omens were : a snake, oil, an enemy, a one-eyed man, etc.

Birds whose names have masculine terminations are happy omens if seen on the left by a physician on his way to the house of the patient, while birds on a similar occasion, whose names have a feminine ending, are auspicious if seen by him on the right. A dog or a jackal seen running from right to left is a happy omen, and so is a mongoose or a Chasha bird if seen on the left. A hare, a serpent, or an owl seen on either side of the road, is an inauspicious sight. The sight and sound of a *godha* or a *krikalaṣa* (an animal of the lizard species) are both inauspicious.

Particular attention was paid to the dreams of the patient. Both Charaka and Susruta describe such dreams and their import in detail. Whoever (in his dream) goes toward the South (i.e., the region of death and malignant demons), his body anointed with oil or grease, seated on a camel, a tiger, a donkey, a boar or a buffalo, or whomever an old woman drags toward the South, she, dark-skinned, clothed in red, laughing and dancing with dishevelled hair (i.e., an apparition of the great goddess, the Devi, in her terrific aspect of Kālī in her frantic dance, devouring her victims), or whoever is embraced by spirits who are tortured in hell (evidently he is already in the company of the dead ; they bid him welcome), or by ascetics (who have severed the bonds of earthly life and do not care whether their bodily frame carries on or dissolves), or whomever wild beasts with distorted faces sniff about the head (as if he were a corpse), or whoever drinks honey or sesamum oil (which form part of the offerings to the deceased), or whoever sinks into mud, or dances and laughs, his body smeared with mud (i.e., his appearance resembles a *bhūta* or ghost), or whoever is stripped of his clothes and wears a red garland on his head (like a delinquent facing capital punishment), or whoever grows a bamboo or a reed or a palmyra tree out of his breast (as though he were already turned into dust and formed part of the ground), or whoever is swallowed by a fish or has intercourse with his mother, or whoever falls from the top of a hill, or into a chasm full of darkness, or is carried away by a swift stream, or whoever grows bald or is overcome and bound by crows and similar animals, or whoever beholds stars falling from the sky, whoever sees a lamp extin-

guished or experiences the loss of sight, or whoever beholds the gods on their thrones or the earth shaking, whoever experiences vomiting, or evacuation, or whose teeth fall out, or whoever climbs a cotton tree (*salmali*; a region of hell is called after it), or a *kimsuka* tree (the red blossoms of which adorn the victim of the executioner) or a sacrificial post (to which the victim is fastened to be slaughtered), or whoever ascends an anthill, a coral tree, a *kovidara* tree in full blossom or a funeral pyre, or whoever receives raw cotton, sesamum oil, oil-cakes or iron objects, or whoever eats cooked food or drinks liquor (in his dream); if he be healthy he will contract a disease, and if he be diseased, he will come to death.

Certain dream symbols are associated with specific maladies; friendship and intimacy with dogs is related to fever, friendship with monkeys with consumption.

Auspicious visions in dreams are: gods, brahmins, "twice-born" people of the three upper castes, living friends and kings; a brightly burning fire, or flawless clear water promises luck and the vanishing of disease. Meat, fish, fruit, white garlands and clothes purport financial success and the vanishing of disease. If the dreaming person ascends stately terraces, climbs trees laden with fruit, mounts elephants and ascends mountains, this points to material gain and the vanishing of disease. If he achieves the crossing of streams, great rivers and oceans full of turbulent and muddy water, this is a sign of good fortune and the vanishing of disease. If a snake or leech or insect bites him, a clever man should interpret this dream as denoting freedom from disease, and gain of money. A patient who sees auspicious dreams of this kind may be diagnosed as possessed of long life (*dirghāyus*), and the doctor should accept the treatment of the case.

CHAPTER VI

MATERIA MEDICA

The collection of vegetable, animal and mineral substances for the purpose of treatment of diseases seems to be almost as ancient as man himself on the earth. The earliest records of materia medica date back to the days before Tutankhaman, i.e., 2000 B.C. Egypt and Mesopotamia possessed very extensive and varied materia medicae. We know now that the Indus Valley Civilisation was contemporaneous with these two ancient civilisations and it is not surprising, therefore, to find that the Indian materia medica bears a very close resemblance to theirs. These countries had each its own pharmacological lore dating back to pre-historic times. The Indian materia medica was well known to the ancient world and brisk trade existed in medical drugs between India and other countries. Many medicinal plants or drugs were exported to the West, such as spikenard, cinnamon, pepper, sesame orientalia, cardamom, cane-sugar, etc., and these were held in great esteem, special voyages being undertaken to procure them.

Indian materia medica, as it exists today, is the burdensome legacy of ages. Its origin dates back to pre-historic times. The metrical parts of the Vedas contain the earliest documents available about it, as the Indus Valley script is still undeciphered. Vedic medicine was magico-religious and did not distinguish between medicine, magic and religion. It believed that diseases were caused by supernatural agents, such as the sorcery of enemies, possession by evil spirits and demons or the anger of certain gods. Amulets, medicines, philters, witchcraft and other devices of magic were the methods used in the treatment of diseases. In the Atharva-veda itself, only a few medicines are mentioned, such as jangida, gulgulu, kuṣṭa and sata-vara, and these are all to be used as amulets for protection, not only against certain diseases, but also from the witchcraft (*kr̥tya*) of enemies. The effect of these herbs was of the same miraculous nature as that of mere charms or incantations. They did not operate in the manner in which medicines are supposed to act in rational therapy, but in a supernatural way, like charms, magic, etc.

In most of the hymns, which appear as pure charms, the *Kausika Sutra* of the Atharva-veda directs the application of various medicines either internally or as amulets. In fact, the medicines were intended as a sort of amulet worn internally.

This does not mean that the Vedic people had no other ideas about the medicinal virtues of herbs. Two hymns, one from the Atharva-veda and the other from the Rigveda, give us a very good idea of the knowledge they had. The first is from A.V. VIII. 7. This is a charm for bestowing longevity; the divinities to whom it is addressed are the herbs mentioned in the hymn, which was used in a remedial rite against consumption (*yakṣma*) and all other diseases, together with a gilt and lacquered amulet of splinters from ten kinds of trees which is sprinkled with the residue of the sacrificial portion offered to the gods. The origin of the herbs is extolled: these plants, fathered by Heaven, mothered by Earth, whose root is the primal cosmic ocean, are described as of all gods mighty, life-giving to man. The various parts of the plants used are mentioned: "rich in sweetness the root, rich in sweetness the tip, rich in sweetness has grown the middle of these plants; rich in sweetness the leaves, rich in sweetness the flowers of these, partaking of honey, a drink of the elixir of immortal life (*amṛta*).” Even the animals know the healing power of the herbs: "that plant the boar knows, that remedial herb the mongoose knows, those the serpents know or the Gandharvas know, those I call to his aid. Whatever herbs, related to the *angiras*, the eagles, whatsoever divine ones the bees know, whatsoever the birds, the swans know, and all winged ones, of however many herbs the inviolable kine eat, of however many the goats eat, in however many herbs the human physicians find a remedy, so many, all remedial, do I bring unto thee."

The second hymn is from the Rigveda X. 97. This hymn first extols the virtues of the herbs: "those herbs, the first-born of the gods, three ages of the world ago, those will I worship in my thought, the 107 virtues of those with new tawny sprouts." This hymn then gives a vivid idea of the conception of the Vedic people with regard to the action of drugs. "Those with fruit, those without fruit, those flowerless, and those with flowers, impelled by the Lord of Magic Spells (*Bṛhaspati*), may they deliver from ill, may they deliver me from imprecation, from (the dropsy) that comes from Varuna, and from the Tamer's fetterlock (sickness unto death) and from all god-sent diseases." The efficacy of the herbs is described in a grandiloquent way: flying down from heaven, the herbs spoke: "Whom alive, we

reach, that man does not perish." These verses describe in poetic language the purpose and scope of the healing herbs in Vedic medicine. Impelled by the Lord of Magic Spells, they have to deliver man from ills, imprecations, from sickness unto death and from all god-sent diseases. The Vedic materia medica was the handmaid of the Lord of Magic Spells.

It would appear, from a study of the other hymns, that even at the time of the Atharva-veda there were physicians and an elaborate pharmacopoeia treating diseases with drugs. Thus A. V. II. 9. 3 extols the virtue of the amulets and speaks of their powers being equal to thousands of medicines used by hundreds of medical practitioners. "The praise of the Atharvan as the physician *par excellence* and of the charms being superior to all the medicines prescribed by other physicians implies the existence of two systems of medicine flourishing side by side; the one, the system of charms prescribed by the Atharvan and the second, the system of drugs prescribed by the ordinary medical practitioner. In the period when the above mantras were composed, the value of medicinal herbs was being more and more realised and they were being administered along with the usual Atharvanic rites. The special hymns dedicated to the praise of *jangida*, *kuṣṭa* and others show that the ordinary medicinal virtues of herbs were interpreted on the miraculous lines in which the charms operated. This points to an appreciation of the usefulness of the drug system. On the other hand, the drug system also came under the influence of the Atharva-veda, which came to be regarded as the earliest source of its authority. The period of competition between the two systems may be termed the period of transition from magico-religious medicine to the empirico-rational school of classic medicine. The word *bheṣaja* in the Atharva-veda meant a charm or amulet which could remove diseases and their symptoms, but in later medical literature the word is more commonly used to denote herbs and minerals, either simple or compounded, and this reflects the change that has taken place in the conception of the action of drugs between the two periods.

In Vedic medicine there is not yet any appreciation of disease as produced by natural causes as opposed to supernatural causes. This appreciation developed later in the growth of classical medicine, which attempted to treat many diseases strictly along the lines of rational therapy. In the classical school of medicine, even though the demarcation between diseases due to natural causes and those due to supernatural powers remains undefined, only those which to some extent defy rational therapy are treated

by propitiation and magic. This is quite evident from the division of medicines into the following three classes by Charaka : (1) those that depend for their action upon the deities and invisible influences ; (2) those that depend for their application and action upon knowledge and reason ; and (3) those that appertain to the subjugation of the mind.

Among these, mantras, herbs and plants of invisible virtue (if kept in contact with the body), gems, auspicious rites, offerings in sacrifices, offers of articles to the deities in course of worship or religious rites, libations of meat and ghee on the sacred fire, performance of vows, expiatory ceremonies and rites, fasts, propitiatory rites, vows to the deities, and pilgrimages to sacred waters and shrines, constitute medicines of the first class. This is the legacy which classical medicine inherits from the magico-religious medicine of the Atharva-veda.

Diet and articles of medicinal virtue that are applied with the aid of knowledge and reason are medicines of the second class.

The subjugation of the mind, by withdrawing it from every kind of injurious or harmful act and object of the senses, constitutes medicine of the third class.

Physical ailments, says Charaka, are cured by medicines (*auśada*). All substances, whether animate or inanimate, are to be considered as medicines, provided they are applied in the proper way (*yukti*) and for specific purpose (*artha*). (C.S. I. 25. 27). So Charaka at the beginning of his *samhita* classifies all the substances that are used as medicine.

Objects are known to be of three kinds : animal products, vegetable products, and products appertaining to the earth.

Honey, secretions, bile, fat, marrow, blood, flesh, excreta, urine, skin, semen, bones, tendons, horns, nails, hoofs, hair; bristles, and the bright pigment called *Gorochana*, are the animal products used as drugs.

Gold, the ordure of metals, the five metals (silver, copper, lead, tin and iron), sand, lime, red arsenic, gems, salt, red chalk, and antimony are indicated as drugs appertaining to the earth.

The vegetable products are of four kinds : *vanaspati*, *virūdh*, *vānaspatya* and *ośadhi*. Trees or plants that produce fruit (but not flowers) are called *vanaspati* ; those that produce both fruit and flowers are *vānaspatya* ; those that perish upon the ripening of their fruit are *ośadhi* ; while creepers are called *virūdh*.

The vegetable products are root, bark, pith, exudation, stalk, juice, sprout, cinders, milk, fruit, flowers, ashes, oil, thorns, leaves, sheath (of a bud), bulbous root and shoots. There are four kinds of principal oil, five kinds of salt, eight kinds of urine,

eight kinds of milk, and six kinds of plants for the correction of maladies (C.S. I. 1).

Susruta divides living objects into two classes: *sthāvara* (movable) and *jangama* (immovable); of these the *sthāvara* are sub-divided into four classes: *vanaspati*, *vrikṣa*, *virūdh* and *oṣadhi*. Trees bearing fruit without producing flowers are called *vanaspati*. Those plants which bear both flowers and fruit are called *vrikṣa*. Creepers and plants resembling a bundle of grass are called *virūdh*. Those plants which die after their fruit has ripened are called *oṣadhi*.

Animals are divided into four classes, according to their origin from the uterus, eggs, decomposing animal matter or from the earth respectively.

Of vegetables, bark, leaves, flowers, fruit, roots, tubers, exudation and juice are useful in medicine. Of animals, skin, nails, hair, blood, etc., are useful. *Pārthiva* or minerals are gold, silver, gems, pearls, orpiment, earth, earthen pan, etc.

Gales, winds, sunshine, shade, moonshine, darkness, heat, cold, rain, day, night, fortnight, month, seasons, solstices, etc., should be deemed as the work of eternal time, which, by virtue of their natural effects, contribute to the accumulation, augmentation, pacification or diminution of the deranged bodily *doṣas* (*vāyu*, *pitta* and *kapha*).

Physicians should look upon the four factors of food, conduct, earth, and time as the accumulators, aggravators and pacifiers of the deranged bodily *doṣas* and of the diseases resulting from them.

The term medicine signifies drugs and their virtues, tastes, potency, inherent efficacy (*prabhāva*) and reactionary properties (*vikalpa*). Appliances (*kriya*) denote such processes as surgical operations, injections, emulsive measures, lubrications, etc. The term time signifies all opportune moments for medical appliances (S.S. I. 1).

It is interesting to note the close resemblance between the materia medica of Ancient India and those of Egypt and Mesopotamia, which also consisted of three groups of drugs: vegetable products, animal products and mineral substances. There was also a close resemblance between the materia medica of the Egyptians and that of Mesopotamia.

The Egyptians used the following drugs: lactuca, various salts of lead such as the sulphate (with the action of which in allaying local inflammation they were well acquainted); pomegranate and acantha pith as vermifuge; peppermint, petroleum, nitrate of potash, castor oil, opium, absinthe, juniper (much used as a diuretic), caraway, lotus, gentian, mustard, ox-gall, aloes, garlic,

valerian, bitter infusions, mandragora, linseed, squilla, saffron, resin and various turpentine products, cassia, certain species of cucumis, cedar-oil, yeast, colchicum, nasturtium, myrrh, tamarisk, powdered lapis-lazuli, vinegar, indigo, the oasis onion, mastic and other gums, mint, fennel, henbane, or hyoscyamus, magnesia, sebeste (a tonic and cough medicine), lime, soda, and iron. Precious stones were employed in a finely powdered condition. The drugs drawn from the animal kingdom form the most disgusting portion of their materia medica, consisting of flesh, brains, liver, lungs, blood, and organs of generation of animals; besides these they used the excrements of various animals, both internally and externally. Mercury in the form of sulphide is recorded in the Papyrus Ebers (1550 B.C.) as being used by the ancient Egyptians.¹

The Mesopotamian materia medica was very similar to that of Egypt. The vegetable drugs were almost the same. Among the more effective vegetable drugs were hellebore, hyoscyamus, mandrake, opium and hemp. When we come to the animal drugs, we find all the elements of the dreckapothke represented: urine, faeces, hair, ground bones of animals; fat, blood, liver, meat, and other parts of various animals.²

Much more important was the use of mineral substances, of which the Babylonians and Assyrians had considerable knowledge. Mineral drugs occur frequently in recipes for diseases of the eyes, and here, as in Egypt, sulphur was used in the treatment of skin diseases. Among the chemical elements and compounds encountered in Assyrian prescriptions, we find white and black sulphur, sulphate of iron, arsenic, yellow sulphide of arsenic, arsenic trisulphide, black salt-petre, antimony, iron oxide, magnetic iron ore, sulphide of iron, pyrites, copper dust, verdigris, mercury, alum, bitumen, naphtha, calcined lime and a variety of unidentified stones.³

Thus it will be seen that there is nothing distinctive about the materia medica of the ancient Indians. It consisted of vegetable, animal and mineral products; almost all the vegetable products being also met with in the other materia medicae. The only limitation was the availability of a plant in a given area. All that can be said of the Indian materia medica is that, of all the medicinal plants mentioned in it, not a single one was European. One notable fact may be mentioned: while Egypt as well as Mesopotamia used opium, this drug does not occur in Indian materia medica till centuries later.⁴ It has been claimed that Indians were the first to use mineral drugs, both externally and internally. From a study of the Egyptian and Mesopotamian

materia medicae, this claim can no longer be sustained. All the mineral drugs mentioned in Indian materia medica are met with in the others also. Here also an important fact may be mentioned : mercury was used both in Egypt and Mesopotamia, as mentioned above, but as in the case of opium, it only appears in the Indian materia medica many centuries later.⁵

THE PROPERTIES OF MATERIAL OBJECTS AND THEIR USE IN MEDICINE : Charaka begins his *samhita* with an enumeration of the *Vaiśeṣika* categories. As we have seen before, the entities it admits are six original *padārthas* ; viz., *Dravya*, *Guna*, *Karma*, *Sāmānya*, *Viśeṣa* and *Samavāya*. Charaka enumerates the five *bhūtas*, *manas*, time, space and self as the nine substances (*dravyas*). He then enumerates the *guṇas*. *Guṇas* in *Vaiśeṣika* means qualities and not subtle reals or substances as in the *Sāṃkhya*-yoga system of philosophy. He enumerates the sensible qualities ; viz., sound, touch, colour, taste and smell ; the mechanical or physical qualities, viz., heavy (*guru*), light (*laghu*), cold (*śīta*), hot (*uṣṇa*), viscous (*snigdha*), dry (*rūkṣa*), inactive (*manda*), active (*ūkṣṇa*), motionless (*sthira*), fluid (*sara*), soft (*mṛdu*), hard (*kaṭina*), clear (*visada*), slimy (*picchila*), smooth (*slakṣṇa*), rough (*khara*), bulky (*sthūla*), penetrative (*sūkṣma*), dense (*sāndra*) and liquid (*drava*). Charaka defines a substance (*dravya*) as something which possesses quality (*guṇa*) and action (*karma*) in the relation of inherence and is also the inseparable material cause (*samavāyi-kāraṇa*) of all effects. *Guṇas* are things which are themselves inactive and exist in the *dravya* in an inseparable relation of inherence. The *guṇas* themselves cannot contain any further *guṇas*. The action of medicines is called *karma*, its potency *vīrya*, the place where it operates *ādhi-kāraṇa*, the time of operation, *kāla*, the mode of operation, *upāya*, and the result achieved, *phala*.

If a substance is one which possesses quality (*guṇa*) and action (*karma*) in the relation of inherence and is also the inseparable material cause of all effects, the question arises as to the way in which medicines operate in human bodies. Is it by any specific agency of the substance (*dravya-prabhāva*) or its qualities (*vīrya*) or is it by their joint influence ? From *Susruta*'s account given in 1. 40, it would appear that there was a great deal of difference of opinion regarding the relative importance of *dravya* and its *guṇas*. Among the *guṇas* mentioned above, the ones we are concerned with in this discussion are : taste (*rasa*), hot (*uṣṇa*), cold (*śīta*), moist (*snigdha*), dry (*rūkṣa*), moving (*visada*), slipping (*picchila*), soft (*mṛdu*), and sharp (*ūkṣṇa*).

There were some who held that *dravya* was the most important since it remains permanent, whereas *rasa* etc., are always changing ; it is grasped by the five senses and has its *guṇas* ; it is the support of the qualities (*guṇas*), all operations are performed with the *dravya* not with the *rasa*, and the *rasas* depend largely on the nature of the *dravyas*.

Others held that *rasas* are most important since it is of them that we become directly aware when we take our food and it is they that remove the various *doṣas*.

Others held that the potency (*vīrya*) of things is the most important, since it is by their potency that medicines act.

Others say that the *rasa*, as digested by the stomach, is the most important, since things can produce good or bad effects only when they are digested.

From the above discussion it is evident that the substance (*dravya*) exerts its medicative influence through its qualities, *rasa*, *vipāka* and *vīrya*. This being so, the qualities or *guṇas* may be considered the *sakti* (power) by which the *dravya* exerts its action. Hence *rasa*, *vīrya*, *vipāka* must be considered the *sakti* (potency) of the substance (*dravya*).

But does the *dravya* (substance), apart from its *sakti*, i.e., *guṇas*, possess any independent power or potency ? Susruta holds that apart from the *sakti* (power) as manifested in *rasa*, *vipāka* and *vīrya*, the *dravya* also operates by itself in an unthinkable way (*achintya*), which is also called *prabhāva* and which is comparable with the attractive force exerted by the magnet on iron. The *dravya* is thus differentiated from its *sakti* and is said to possess a peculiar operative mode of its own as distinguished from that of the *sakti* or potency as manifested in *rasa*, *vipāka* and *vīrya*. Susruta is of the opinion that *rasa*, *vipāka*, *vīrya* and *prabhāva* are all important, since a drug produces effects in all the four ways according to its nature. Susruta holds, therefore, that the medicative influence of a drug is exerted both by virtue of the specific agency of the substance (*dravya-prabhāva*) and by the specific agency of its qualities, *rasa*, *vipāka* and *vīrya*, and also by their joint influence.

According to Charaka, *rasa*, *vipāka* and *vīrya*, themselves being *guṇas*, cannot possess further *guṇas*. He does not admit a *sakti* as apart from the *dravya*. Thus, while Susruta holds *prabhāva* to be a specific *sakti* or thing operating in an unaccountable way, Charaka thinks that this *sakti* is identical with the thing itself. Potency is the nature of things and is no separate property distinct from them. *Vīrya* in its general sense means the potency or power of medicines to produce effects and as such

includes within it both *rasa* and *vipāka*, but since these have special names the term *vīrya* is not applied to them. *Vīrya* is believed to be more powerful than *rasa*, so that when the *vīrya* and *rasa* of a thing come into conflict, it is the *vīrya* which dominates and not the *rasa*.

The theory of *rasa*, *vipāka*, *vīrya* and *prabhāva* resulted from the attempt to explain the action of drugs on the human body. Since none of the chemical effects (in the modern sense) of medicines were known, an attempt was made to explain this action on the basis of an easily recognisable quality like *taste*. But it is obvious that a classification based on *rasa*, though simple, could not be universally true; for though the taste is some indication of the medicinal property of a substance, it is not an infallible one. There are so many combinations of taste. (Charaka and Susruta mention 63 such) that it is difficult to identify them, and besides they change after digestion, and the taste before digestion would be no indication of that which results after digestion. Even on this question there was difference of opinion, Charaka holding that there were three *rasas* after digestion, while Susruta held the view that there were only two produced as a result of digestion. This ultimate taste only could be taken as the basis of selection of drugs. But there were many other effects of medicine which could not be explained on the above assumptions. In explaining these, the theory of *vīrya* was introduced. In addition to taste, substances were considered to possess other properties such as heat and cold, as judged by inference, factual properties of slipperiness, movement, moisture, dryness, sharpness, etc., as manifested by odour. These were supposed to produce effects in suppression of *rasa* and *vipāka*. It was only in cases where no sensible data of any kind could be found to indicate the medicinal properties of a substance that the idea of *prabhāva* was introduced. This idea of a power possessed by the substance, which acts mysteriously in an unaccountable manner, is a hangover from Vedic medicine. We have seen that in the Atharva-veda there were two kinds of medicines, those which acted in a supernatural way and those which acted in a rational way. Amulets, charms and incantations were supposed to act in a supernatural way. Their action was unpredictable. *Prabhāva* corresponds with this idea of the action of amulets. According to Charaka and Susruta, it was the mysterious operation of a medicine acting in an unaccountable way, so that two medicines exactly similar in *rasa*, *vipāka* and *vīrya* had different medicinal effects.

The theory of *rasa* plays an important part in Āyurveda in the

selection of medicines and diet, in diagnosing diseases and prescribing appropriate treatment. Disease is the result of the increase or decrease of the *dhātus* and the main aim of Āyurveda is the restoration of the ingredient *dhātus* of the body to their normal state. The main task of the Indian materia medica was, therefore, to investigate how this aim could be attained by the use of diet and medicines. These have an effect on the *dhātus* of the body and on their disequilibrium through the influence of *rasa*, *vipāka*, *vīrya* and *prabhāva*. *Dravya*, *rasa*, *vipāka* and *vīrya*, each exert an action on the *doṣas*. The principle which underlies the application of this knowledge about the action of drugs in medicine is the maxim of *sāmānya* and *viśeṣa*. Substances having similar constituents or characteristics will increase each other, while those having dissimilar constituents or characteristics will decrease each other.

PROPERTIES OF MEDICINES WITH REFERENCE TO THEIR PHYSICAL CHARACTERISTICS : All material objects are produced by a combination of the five *bhūtas*, earth, water, fire, air and ether. According to the predominance of one or another of these, they are called earthy (*pārthiva*), watery (*āpya*), fiery (*āgneya*), airy (*vāyavya*) or ethereal (*ākāśātma*).

Earthy objects have the properties of thickness, density, compactness with interstices, heaviness, firmness, roughness, weight, hardness, strong smell, slight astringency, and generally a sweet taste. They increase strength and firmness, and have a tendency to fall downwards.

Watery objects or articles in which water predominates have the properties of coolness, moistness, oiliness, heaviness, weight, mobility, compactness with interstices, softness and smoothness of surface; they have abundance of juice, and have slightly astringent, acid, saline and sweet tastes. They increase the lubricity of the body and its secretions and excretions strengthen the joints and promote cheerfulness.

Articles which have the element fire in excess have the properties of heat, pungency, thickness, dryness, roughness, lightness and clearness. They have a great variety of shapes and properties and have slightly acid, saltish and acrid tastes and a tendency to ascend upwards. They act as caustics, suppurants, rubefacients and calorificants. They heighten the appearance, splendour and colour of the skin.

Articles with a predominance of air in them have the properties of thinness, dryness, roughness, coldness, lightness and clearness. They cause various kinds of sensation to the touch; they are slightly bitter and particularly astringent. They produce

clearness, lightness, exhaustion, dryness and irritability of the body.

Articles with predominance of ether in them have the properties of fitness, thinness and mildness. They have aphrodisiac properties and undeveloped and imperceptible tastes and are very sonorous. They produce mildness, porosity and lightness of the body.

On the basis of these characteristics all articles or objects in the world may be classified as medicines, and if they are endowed with energy and other properties and are employed according to reason and necessity, they prove serviceable in the cure of the diseases.

A knowledge of the composition of articles and the predominance of a particular *bhūta* or *bhūtas* in them is of great help in the selection of drugs for use as medicine.

Articles containing an excess of the *bhūtas* earth and water are heavy and owing to their weight they have a tendency to fall downwards. It would seem, therefore, that they act as purgatives owing to their tendency to go downwards.

Articles containing an excess of the *bhūtas* air and fire are light, as both air and fire are light, and owing to their lightness they have a tendency to ascend. It would seem, therefore, that they cause emetics from their tendency to ascend.

Articles which possess in abundance both the property of going upwards and downwards act both as emetics and purgatives.

Articles which possess in abundance the *bhūta* ether act as alteratives.

Articles that contain in abundance the element air act as astringents, owing to the drying power of air.

Articles that contain in abundance the *bhūta* fire promote digestion, and articles that contain in excess the *bhūtas* air and fire act as absorbents or liquefacients.

Articles which possess in excess the *bhūtas* earth and water act as medicines to promote nutrition.

The primary cause of disease is *dhātu-vaiṣamya*, that is, the increase or decrease of the *doṣas*, *vāta*, *pitta* and *kapha*, either singly or in combination. The chief use of medicines is for their action on the *doṣas*.

Articles in which the *bhūtas*, earth, fire and water predominate, keep the *doṣa vāyu* in check. *Vāyu* is increased by articles with an excess of air and ether. The *doṣa pitta* is reduced by articles with an excess of the *bhūtas* earth, water and air and is increased by articles with an excess of the *bhūta* fire. *Kapha* is reduced by articles with an excess of the *bhūtas* ether, fire

and air and is increased by articles containing an excess of the *bhūtas* earth and water.

With the above knowledge, drugs should be used in the treatment of diseases either singly or in combination of two or more at a time.

Materials used as medicine are not merely compounds of the five *bhūtas*; they possess in addition various qualities or *guṇas*. Of these one of the most important is taste (*rasa*). The tastes (*rasas*) are six: sweet (*madhura*), acid (*amla*), saline (*lavana*), hot and pungent (*kaṭu*), bitter (*tikta*), and astringent (*kaṣāya*). The source of all these *rasas* is water. The seats of *rasas* are the essence of the five *bhūtas*, modified in accordance with the following five conditions: (1) specific nature of the substance (*prakṛti*); (2) as acted upon by heat or other agents (*vikṛti*); (3) association with other things (*vicāra*); (4) the place in which the substance is grown (*desa*); (5) the time at which it is produced (*kāla*). As regards the origin of *rasas*, it is suggested that water gets mixed with the five *bhūtas* in the air and also after its fall on the ground. All the five *bhūtas* are present in all the *rasas*; but in each *rasa* one or more of the *bhūtas* predominate, and in accordance with this, the various *rasas* differ from each other. Thus, with the predominance of *soma* (water) there is a sweet taste; with the predominance of earth and fire, an acid taste; with the predominance of water and fire, a saline taste; with the predominance of air and fire, a hot and pungent taste; with the predominance of air and *ākāśa*, a bitter taste; with the predominance of air and earth, an astringent taste (C.S. I. 26).

With regard to the action of the tastes on the *doṣas*, the sweet, acid and saline tastes decrease the *doṣa vāyu*; the sweet, bitter and astringent tastes decrease the *doṣa pitta*; and the acrid, bitter and astringent tastes decrease the *doṣa kapha*. Air is neutral and has its own properties. Bile is hot. Phlegm is cold. These tastes increase the properties analogous to their own and decrease or antagonise those opposed to them.

With regard to potency or *vīrya*, the sweet, bitter and astringent tastes are said to be cool, and the acrid, acid, and saline tastes hot. Coolness, dryness, lightness, clearness and obstruction are the characteristics of air (*vāyu*), while the astringent taste is synergist to air; i.e., it produces the same sort of effects. Heat, sharpness, dryness, lightness and clearness are the properties of *pitta* (bile). The acrid tastes produce these effects. Sweetness, oiliness, heaviness, coolness and lubricity are the properties of *kapha* (phlegm). The sweet taste produces these effects.

Susruta divides all substances used in medicine into six groups based on the six *rasas* or tastes. He describes the uses of these six groups and the results of abuse. The sweet group increases the *dhātus* of the body, improves the complexion, strengthens the body, heals wounds and ulcers, and purifies the *rasa* and the blood. The acid group is carminative and digestive, expels wind from the bowels, and accumulates secretive impurities in the tissues. The saline group purifies tissues, is digestive and relaxing, separates impurities, accumulates excretions in the system, causes the body to lose its tone, i.e., relaxes it, clears the outlets of the system and produces softness of all the structures of the body. The pungent group increases digestive power, purifies the body, prevents corpulence, causes relaxation of ligaments of the joints and of the system in general; diminishes formation of milk, semen and fat. The bitter group separates the *doṣas*, is appetising, digestive and purifying, improves secretion of breast milk, and reduces the quantity of faeces, urine, perspiration, fat, marrow and pus. The astringent group is styptic and favours the healing of ulcers, checks all discharges, separates impurities from tissues, reduces corpulence and superfluous moisture.

We mentioned above that the tastes of substances taken as food alter during digestion. Some authorities held that *rasas* remained unchanged during digestion. Charaka held that there were only three kinds of *rasa* resulting from digestion or *pāka*: sweet (*madhura*), acid (*amla*), and hot (*kaṭu*). Susruta held that there were only two: sweet (*madhura*) and hot (*kaṭu*). He was of the opinion that the acid taste was not the result of digestion but it was the *pitta* which was turned into the acid taste. Those objects which have more of earth and water in them are turned into the sweet taste, and those which have fire, air and *ākāśa* in them are turned into the hot taste (*kaṭu*). For medicinal purposes only the taste that resulted from digestion counted.

We have seen that *vīrya* in its general sense meant the potency or power of a drug to produce effects. Some authorities held that this potency (*vīrya*) was only of two kinds, hot (*uṣṇa*) and cold (*śīta*). Charaka and Susruta held that it was of eight kinds, hot (*uṣṇa*), cold (*śīta*), moist (*snigdha*), dry (*rūkṣa*), moving (*visada*), slippery (*picchila*), soft (*mṛdu*) and sharp (*ākṣṇa*). If the *bhūta* fire predominates in an article, then it has the hot and sharp *vīrya*. When the *bhūta* water prevails, the cold and slippery *vīryas* are found. In articles containing an excess of the *bhūtas* earth and water, the moist *vīrya* is present. Objects with excess of the *bhūtas* ether and water have the softening *vīrya*.

Excess of the *bhūta* air causes the drying *vīrya*. When the *bhūtas* earth and air predominate, the moving *vīrya* results. These *vīryas* also have an effect on the *doṣas*. The hot and oily *vīrya* removes *vāyu*; cold, mild and slippery *vīryas* destroy *pitta*; sharp, dry and moving *vīryas* destroy *kapha*.

Besides *rasa*, *vipāka* and *vīrya*, substances possess the quality of being heavy or light. Charaka writes that this distinction between articles of diet is not without reason. The articles called 'light' contain largely the properties of air and fire, while those called 'heavy' contain largely those of earth and *soma* (water). Susruta says that the *sāstras* mention two sorts of digestion, sweet and hot (*kaṭu*). Of these, the sweet digestion is heavy and the hot (*kaṭu*) is light. The five *bhūtas* earth, water, fire, air and ether, may be divided into two classes according to their properties of light and heavy. Earth and water are heavy, while fire, air and ether are light. Heavy digestion checks the *doṣas* *vāta* and *pitta*, while light reduces *kapha*. In heavy digestion there is derangement of *kapha* and in light digestion of *vāta*.

The theory of *rasa*, *vipāka*, *vīrya* and *prabhāva* formed the basis of ancient Indian pharmacology. The main task of their materia medica was to determine the composition of the various drugs and classify them as earthy (*pārthiva*), watery (*āpya*), fiery (*āgneya*), airy (*vāyavya*) and ethereal (*ākāśātmaka*), their tastes (*rasas*), their tastes after digestion (*vipāka*), their potency (*vīrya*) and *prabhāva* (special power). No sharp line could be drawn between articles of food and drugs, as both were used in the treatment of diseases. So the above task included the determination of the composition, *rasa*, *vipāka* and *vīrya* of articles of food also. This task was carried out with such thoroughness and completeness that it must be considered the finest achievement of Indian medicine. A thorough knowledge of the various articles of food and drugs with their qualities was considered essential for a practising physician.

"The goat-herds, the shepherds, and the cow-herds, who frequently go to the woods, and those who live in the woods, know plants by name and appearance. It is not, however, by mere knowledge of names and appearance that one can be said to know the plants completely. He who knows the names and appearance of plants and can combine them (according to their properties) is said to be a knower of plants. But he who knows plants fully (i.e., their names, appearance, properties, actions, applications, etc.) is a physician. But he who is acquainted with their applications according to the considerations of time and

place, after having observed (their effects on) individual patients, should be known as the best of physicians" observes Charaka. Again he says : "An unknown drug is like poison or weapon or fire or thunder, while a known drug is like nectar (*amṛta*). Drugs known by name, appearance and properties, or misapplied even if known, produce mischief. Well-applied, a virulent poison even may become an excellent medicine, while a medicine misapplied becomes a virulent poison."

He is regarded as a physician that is conversant with the tastes (*rasas*), all articles (of food and drink), the faults (*doṣas*), and diseases, in respect of their potency (or virtues), and that knows (the virtues of) place and time, as also of the body (i.e., the elements that constitute it and their respective functions) (C.S. III. 1. 35).

CLASSIFICATION OF MEDICINES : The most logical classification is the one adopted by Susruta. Medicines are employed in treatment for the purpose of restoring the deranged *doṣas* and *dhātus* to their normal state. So the only logical and rational classification is that based on the action of drugs on the *doṣas* and *dhātus*. The *doṣas* may collect and then get excited and then begin to spread. Later they increase in amount beyond the normal measure. In the first case, they have to be brought to their normal state and in the second case, they have to be got rid of from the system. Accordingly, Susruta divides medicines into two classes, viz., *samsamana* and the *samsodhana*. The former are medicines which rectify the deranged state of the *doṣas* and calm their excited action without promoting their excretion. This class is sub-divided into three orders : *vātasamsamana varga*, *pittasamsamana varga* and *śleṣmasamsamana varga*. The latter are medicines which remove collections of deranged *doṣas* from the body by promoting their excretion. This class of drugs include emetics, purgatives, errhines and depuratories. Susruta gives another classification in which he includes about four hundred drugs under 37 *gaṇas* (groups) according to the diseases for which they are used, giving them names according to the first plant of each group. The drugs of the first *gaṇa*, or group, remove derangements of *pitta* and *vāyu* and cure wasting, abdominal tumours, pain in the limbs, cough and difficulty in breathing. Similarly for every *gaṇa*, besides their action on the *doṣas*, the symptoms or the conditions they alleviate are also mentioned. Thus abdominal tumours, cough, difficulty in breathing, headache, internal abscesses, calculus in the bladder, gravel, painful micturition, suppression of urine, discharges from the vagina, intestinal worms, skin diseases, ulcers, jaundice, piles, prurigo, diarrhoea, tympha-

nitis, ascites, fever, haemorrhages, tonics, malnutrition, wounds and fractures, diseases of the eye, etc., are the conditions in which the drugs are employed. While the first action, that on the *doṣas*, is rational, the second action, that on the various *dhātus*, is purely empirical.

Charaka divides medicines into 50 classes, according to their supposed action on the different organs of the system, or on particular symptoms of the disease. These classes are as follows :

- (1) *jīvanīya*—medicines which prolong life ; (2) *brinhanīya*—medicines which promote nutrition and increase corpulency ; (3) *lekhanīya*—medicines which thin the tissues or reduce corpulency ; (4) *bhedanīya*—promote excretions ; (5) *sandhānīya*—promote the union of fractured or divided parts ; (6) *dīpanīya*—increase the appetite and digestive power ; (7) *balya*—increase strength, tonics ; (8) *varnya*—improve the complexion ; (9) *kanthya*—improve the voice or cure hoarseness ; (10) *hṛdya*—promote cheerfulness or relish ; (11) *triptighna*—remove a supposed phlegm which causes a sense of satiety ; (12) *arsoghna*—cure piles ; (13) *kushtāghna*—cure skin diseases ; (14) *kandūghna*—cure pruritis ; (15) *krimighna*—cure worms ; (16) *viṣagna*—act as antidotes to poisons ; (17) *stanyajanana*—promote secretion of milk ; (18) *stanyasodhana*—improve the quality of milk ; (19) *sukrajanana*—increase secretion of semen ; (20) *sukrasodhana*—purify the semen ; (21) *snehopaga*—emollients ; (22) *swedopaga*—diaphoretics ; (23) *vamanopaga*—emetics ; (24) *virechanopaga*—purgatives ; (25) *āsthapanopaga*—medicines for use in enemas ; (26) *anuvāsanopaga*—medicines for oily enemas ; (27) *sirovirechanopaga*—promote discharge from the nose ; (28) *chhardhinigrahana*—relieve vomiting ; (29) *trishnānigrahana*—relieve thirst ; (30) *hikka nigrahana*—relieve hiccup ; (31) *purīshasangrahanīya*—render the faeces consistent ; (32) *purīshavirechanīya*—alter the colour of the faeces ; (33) *mutrasangrahanīya*—reduce the secretion of urine ; (34) *mutravirajanīya*—alter the colour of the urine ; (35) *mutravirechanīya*—increase secretion of urine, (36) *kāśahara*—cure cough ; (37) *svāśahara*—cure difficult breathing or asthma ; (38) *sothahara*—cure anasarca or swellings ; (39) *jvarahara*—febrifuges ; (40) *sramahara*—remove fatigue ; (41) *dahaprasamana*—relieve burning or heat of the body ; (42) *sītaprasamana*—relieve a sense of coldness ; (43) *udardhaprasamana*—cure urticaria ; (44) *angamarddhaprasamana*—relieve pain in the limbs ; (45) *sūlaprasamana*—cure pain in the bowels ; (46) *sonitāsthāpana*—styptics ; (47) *vedanāsthāpana*—anodynes ; (48) *saṁjñāsthāpana*—restore consciousness ;

(49) *prajāsthāpana* — cure sterility; (50) *vayasthāpana* — prevent the effects of old age (C.S. I. 4. 9 to 19).

Besides the drugs and prescriptions for the treatment of diseases brought about by *dhātu-vaiṣamyā*, Charaka describes two other classes of medicines called *rasāyana* and *vājīkaraṇa* for the general toning up of the system of healthy persons. These medicines are not specifics for any particular disease but are intended to improve the strength of the patients and alleviate diseases in general.

Rasāyana : These medicines are called *rasāyana* on account of their capacity to impart superior *rasa* and *dhātus*. They are elixirs of life for preserving and increasing vigour, restoring youth, improving memory and preventing disease.

Vājīkaraṇa : These medicines are for increasing virile power and producing progeny. (C.S. VI. 1).

Charaka gives very detailed instructions for the preparation of these medicines. He gives the prescriptions for the making of *brahmya*, *amlaka*, *haritaki*, *pranakamiya rasāyanas* and also for the preparation of the famous *Chyavana Prasa*, which was supposed to be the foremost of all *rasāyana* medicines. It is said to be specially alleviative of cough and asthma. It nourishes the weak, the wounded, the old, and those that are of tender years. 38 ingredients, mostly fruits, roots and juices, were used in its preparation. In another *rasāyana*, the *brahmya*, 21 ingredients were used. These were reduced to a powder, to which were added gold, silver, copper and black iron.

Great results were claimed for these medicines. Thus through the use, it is said, of the *rasāyana amlaka* the rishis got back their youth and succeeded in living for many centuries, free from disease and endued with great strength of body, of understanding and of the senses. In C.S. VI. 1. 77, a compound of herbs is advised, which, along with many other virtues, had the power of making a person invisible. Miraculous powers were ascribed to the fruits of *amlaka* (Emblic Myrobalan), and those who ate them according to the prescribed rites would be visited by the goddess Siri. In C.S. VI. 1. 80, it is said that the *rasāyana* medicines not only procure long life, but if they are taken in accordance with proper rites, a man attains the immortal Brahman. These results remind us of the charms and amulets of Vedic medicine which acted in a supernatural and non-medical manner. It is obvious that the efficacy of the drugs used was more or less a matter of faith, based on ancient usage and previous experience.

FORMS OF MEDICINE : The following forms were used :—

1. *Chūrṇa* or powders are prepared by grinding drug substances in a mortar with a pestle and passing the powder through a cloth.

2. *Svarasa* or expressed juice is prepared by pounding fresh vegetables in a mortar, expressing the juice and straining it through a cloth.

3. *Kalka* or paste is prepared by grinding dry or fresh vegetables on a stone with a muller and then making a thin paste, with the addition of water where necessary.

4. *Kvātha* or decoctions are, as a general rule, prepared by boiling one part of vegetable substance with 16 parts of water, till the latter is reduced to one-fourth. The medicines should first be pounded small, then boiled over a slow fire, and the decoction strained through cloth. Decoctions are administered with the addition of salt, honey, sugar, treacle, alkalies, clarified butter, oil, or some medicinal powder.

5. *Phāṇṭa* or infusions are prepared by steeping one part of powdered herbs in 8 parts of hot water, for 12 hours during the night. They are administered in the same way as decoctions.

6. *Sītakaṣaya* or cold infusion is prepared by steeping one part of a drug in six of water for the night and straining the fluid in the morning.

7. *Pāṇiya* is a weak form of decoction prepared by boiling one part of medicinal substances in 32 of water till the latter is reduced to one half. This preparation is usually taken *ad libitum* for quenching thirst.

8. *Pramathyā* is a sort of decoction in which the medicines are first reduced to a pulp and then boiled in 8 parts of water till the latter is reduced to one-fourth. It is administered with the addition of honey.

9. *Mantha* is an emulsion of medicines in fine powder with 4 parts of cold water.

10. *Kshīrapāka* or decoctions in milk. The proportions in this preparation are 1 part of medicine, 8 of milk and 32 of water. The materials are boiled together, till the water is evaporated and the milk alone remains. The decoction is then strained.

11. *Yavāgu*. Sometimes medicines are added to powdered rice, wheat, barley, etc., and boiled with water into a gruel which is eaten. The proportion of water in this preparation is 6 to 1 of solid materials.

12. *Avaleha* or extract. To prepare it, decoctions, after being strained, are again boiled down to the consistence of a thick paste.

Extracts are administered with the addition of sugar, decoctions or powders.

13. *Vatikā* and *Gudikā* or pills and boluses. These are usually prepared by reducing a decoction of vegetable substances to thick consistence and then adding some powder for making a pill-mass. Sometimes pill-masses are made of powdered medicines with the addition of treacle or honey.

14. *Modaka* or boluses prepared by adding powders to cold syrup and stirring them together till uniformly mixed. No boiling is required in this preparation.

15. *Khandapāka* or confections. These are made by adding syrup to medicine in fine powder and stirring it over the fire till intimately mixed and reduced to a proper consistence. Honey is often subsequently added to confections.

16. *Bhāvanā* or maceration of powders in fluids. Powders, and specially mineral substances, are often soaked in various fluids, such as expressed juice of herbs, decoctions, etc., and then dried. For this process the quantity of fluid added to the powder should be sufficient to cover it. The mixture is then allowed to dry in the sun.

17. *Puṭapāka* or roasting. In this process vegetable drugs are reduced to a paste which is wrapped up in leaves, firmly tied with fibres of some sort, covered with a layer of clay from $\frac{1}{2}$ to 1 inch in thickness and roasted in cow-dung fire. When the clay assumes a brick-red colour, the ball is taken out from the fire and broken and the juice of the roasted drug expressed and administered with the addition of honey or such other adjuncts as may be directed. Sometimes the roasted drug is given in the form of a powder or pill.

18. *Kānjika*. This is a sour liquid produced from the acetous fermentation of powdered paddy. Two seers of powdered paddy are steamed in 8 seers of water and laid aside in an earthen pot for 15 days and upwards, when the mixture undergoes acetone fermentation. The resulting fluid is called *kānjika* or *dhānyamla*, i.e., the acid produced from paddy. *Kānjika* is a clear transparent fluid with an acid taste and vinous smell. It is cooling, refrigerent and useful as a drink in fever, burning of the body, etc.

19. *Drāvaka* or distilled mineral acids. A number of mineral substances or salts are heated in a retort and the distilled fluid collected in a glass receiver. Two varieties are generally used, *svalpadrāvaka* and *sankhadrāvaka*. This last preparation contains iron.

20. *Āsava* and *Aṛiṣṭa*, or medicated spirituous liquids. They are prepared from honey and treacle, with the addition of various

medicinal substances. They are all steeped in water and laid aside in earthen jars for vinous fermentation. When raw vegetables are used for fermentation, the resulting fluid is called *Āsava*. When the decoction of drugs only is added, the fermented liquor is called *ariṣṭa*. These preparations are heating, stimulant, easily digested and stomachic.

21. *Ghritās* or medicated oils. These are decoctions of vegetable drugs in oils or *ghrita* (clarified butter) and form a prominent feature of Indian medical practice. They are prepared in great varieties and are extensively used in almost all sorts of diseases. The *ghritās* are chiefly used internally and the oils are rubbed on the body.

22. *Ghritapāka* or preparations of medicated *ghrita*. The *ghrita* or clarified butter is first of all heated on a fire so as to deprive it of any water that may be mixed with it. *Ghrita* thus purified is placed on a fire in an earthen, copper or iron pan and melted with a gentle heat. The medicinal paste and fluids to be used are added and the whole boiled together till the watery parts are all evaporated and the *ghrita* is free from froth. It is then strained through a cloth and preserved for use.

23. *Tailapāka* or medicated oils. In preparing these sesame oil is used. The oil is first boiled to free it of any water it may contain. Then the ingredients are steeped in it for 24 hours and an equal quantity of water is added. After 24 hours the mixture is boiled till the water is evaporated and finally strained. To the oil thus prepared, medicinal substances, in the form of paste, decoction, etc., are added. They are then boiled together till the watery parts are all evaporated. When cool, the oil is strained through a cloth, so as to separate the solid particles. Some medicinal oils are subjected to a third process of boiling with various aromatic and fragrant substances. This is called the *ghandhapāka*.⁶

THE DIFFERENT MODES IN WHICH MEDICINES ARE APPLIED: Besides being taken internally, medicines were applied in various other ways, such as by injections into the rectum, urethra and female organs; application to the nose; to the mouth; to the eyes; to the skin in the shape of plasters, ointments, oils and fumigations and to the lungs by inhalation.

Vastikarma or injections into the rectum were introduced by means of a tube with a membraneous bag tied to the end. The bag was made of the bladder of some animal, such as bull, goat, etc. It was filled with the fluid to be injected and tied to one end of the tube, about 8 inches long and with a tapering rounded extremity for introduction into the rectum. Injections into the

urethra and vagina were introduced by similar contrivances, the tubes being adapted in length and thickness to the passages for which they were intended.

Phalavarti or suppositories were recommended to be made of the size of the patient's thumb. They were smeared with clarified butter and introduced into the rectum.

Nasya or the application of medicated substances to the nose, forms a prominent feature of therapeutics. Two primary classes of medicines for this organ are recognised; viz., *Sirovirechana* or medicines causing a flow of secretion from the nose and thus relieving cerebral congestion, and *Vringhana* or medicated oils applied to the nose with the object of cooling the head and relieving affections of the neck and chest. For clearing the head and promoting discharge from the nose, the expressed juice of pungent drugs is poured into the nose, drop by drop, or powders are blown into the nostrils by means of a tube. The former process is called *avapida* and the latter *pradhamana*. For cooling the head and relieving affections of the upper part of the body, various medicated oils are used. In one form of snuff called *pratimarsha*, 2 or 3 drops of medicated oil are directed to be snuffed up the nostril till they reach the throat, when they should be expectorated and not swallowed. In another form of application called *marsha*, about a drachm of oil is recommended to be gradually poured into each nostril from a spoon or shell.

Kavala or liquids used as gargles. Sometimes a mixture of liquid and solid substances or solid balls of medicines are taken into the mouth and retained in it till they bring on a discharge from the nose and eyes. This mode of application is called *gandusha*. When powders or thick solutions are applied to the gums and the teeth with the finger, the process of medicament is called *pratisarana*.

Sirovasti or applications of oil to the head. This is done in 4 different ways. The first form called *sirovasti*, consists in tying a piece of leather $4\frac{1}{2}$ inches in breadth all round the head, luting its lower margin to the skin by a paste, and then filling the cavity thus formed on the top of the head with lukewarm oil. The oil is retained till relief of pain, or till there is discharge from the eyes and nose. It should then be removed and the head washed with warm water. In the second form, oil or some other fluid is poured in a stream on the head. This is called *pariṣeka*. In the third form called *pichu*, cotton soaked in oil is applied to the scalp; and in the fourth called *avyanga*, the oil is simply rubbed on the head.

Netrakarma or applications to the eyes receive various names according to the nature of the substances used and the manner in which they are applied. When drops are poured into them the process is called *āschothana*. A poultice enclosed within a piece of cloth and applied over the lids is called *pinda*. A paste applied to the lids is called *vidalaka*. Medicines applied to the margin of the lids or to the conjunctiva with the finger or a metallic probe are called *anjana* or collyria. Collyria may consist of powders, or liquids, or sticks or pills. Sticks and pills should be rubbed with water into thin paste.

Swedana consists in the application of heat to the skin for inducing perspiration. It is carried out in four different ways :

1. *Tāpasveda* or application of dry heat by means of heated plates, bricks, sand, cloth or the palm of the hand.
2. *Ūśmasveda* or the application of moist heat or steam. This is effected in various ways. The part to be heated is covered with a wet cloth. Bricks, stones or iron plates are made red hot and sprinkled over with *kānjika* or some decoction, and are then applied to the part to be heated ; or an earthen pot with a small opening in the side is filled with hot water or decoction of some drugs, a tube is adjusted to the hole in the pot and the steam is applied to the covered body through it. A third method consists in heating the ground by burning catechu-wood over it and after removing the fire, sprinkling some decoction over the spot and making a bed of castor oil leaves over it. The patient is to lie on this bed and cover himself with a blanket, or the ground may be covered with a layer of boiled pulse such as *māshakalāya* and a bed made over it for the patient.
3. *Upanāhasveda* or the application of heat by hot medicinal substances in the form of decoctions, pastes or plasters or of fomentation by cloth wrung out of hot fluids ; or heat may be applied by enclosing hot medicinal substances or pastes within a cloth bag and applying the latter to the skin.
4. *Dravasveda* or hot hip bath and hot bath with warm water or decoctions. Milk, broth, oil, *kānjika* etc., may also be used for baths.

Dhūmapāna or inhalations. Tapers or pastilles made of medicinal substances are set fire to and their fumes inhaled through a tube by the mouth or nose.

Dhūpana or fumigations were employed for ulcers and skin diseases. The pastilles for these are made as for inhalation. They are lighted and placed inside two earthen pots placed face to face. A hole is made in the upper pot and a tube

adjusted to it. The free or open end of the tube is now directed to the affected part and the fumes allowed to spread over it.

Kshāra karma or caustic applications. The ancient physicians of India preferred opening abscesses by caustics, to incising them with the lancet. Hence caustics were described as superior to the lancet, inasmuch as, in addition to opening abscesses, they purified them by removing the derangement of the humours. The ashes of many plants were used for the preparation of caustics.

Applications to the skin. These consist of ghrītas, oils, plasters, poultices, baths and hot applications for inducing perspiration. They are for the most part rubbed all over the body, except those intended for local ailments. Plasters called *pralepa* are applied moist and cold. *Pradeha* or poultices are applied moist and hot. They are also thicker than plasters.⁷

CHAPTER VII

TREATMENT

The sole aim of Āyurveda is to advise diet, medicine and a regimen of life, such that, if properly followed, a normal healthy person may maintain the balance of the *dhātus* and one who has lost this may regain it. Those acts by which the constituent elements of the body are rendered harmonious are said to constitute the treatment of disorders or disease and are the duty of the physician. Treatment is adopted with a view to perpetuate the harmony of the *dhātus*, prevent their disharmony and bring them and the *doṣas* back to their normal state of equilibrium when their harmony is disturbed by any cause. (C.S. I. 16. 51 and 52).

Great emphasis was laid on the maintenance of the harmony of the *dhātus*, i.e., on the preservation of health (*dhātu-sāmya*) of the body, as the cure of disease was problematic and the resources of the medical art limited. The purpose of Āyurveda is the protection of the health of the hale and the alleviation of disease of those who are ailing (C.S. I. 30. 21). When persons in health conduct themselves improperly, in respect of diet and deportment, forgetting considerations of measure and season, diseases are generated. One endued with intelligence and desirous of maintaining health should bestow great care upon everything connected with food, deportment and practices. (C.S. I. 7. 43 & 55).

Charaka and Susruta give in great detail the regulations with regard to food, deportment and practices. First of all we have the regulations concerning the daily regimen of life, *dinacharya*. These cover the following :—

1. Daily ablution, regulation of the evacuations, cleaning the teeth by means of fresh stick which is to be taken from the branches of certain trees with a bitter, astringent taste, scraping the tongue, rinsing the mouth, washing the face, application of salves to the eyes, anointing the body with aromatic oil, oiling the head, ears and soles of the feet, care of the mouth (with betel leaves, camphor, cardamom and other herbs), care of the hair, beard, and nails (the latter were to be pared every five days).

2. Meals and diet. Two meals a day, one between 9 a.m. and 12 noon and the other between 7 and 10 p.m. with previous stimulation of the appetite by salt or ginger, directions as to the articles of diet, how to sit at meals, sequence of dishes, moderate drinking at meals (water-drinking at the commencement of meals tends to thinness by delaying digestion, copious drinking at the end of meals to stoutness), careful hygiene of the mouth after meals, a short walk. The most important articles of diet were : the various cereals, particularly rice, fruit, vegetables, nuts, ginger, garlic, salt, water (rain-water the best), milk, oil, butter; honey, sugar-cane; the best kinds of meat were considered to be game birds and buffalo-meat; less wholesome were pork, beef and fish; the amount of food to be regulated by the capacity of the digestion.

3. Exercise and rest, massage, baths and clothing, gymnastics, sleep (by day only after great exertion, by night until an hour before sunrise). Warm and cold baths, a daily bath (considered harmful after eating, with a chill, with a cold, fever, diarrhoea or diseases of the eyes or ears), warm bathing or washing was good only for the lower half of the body, for the upper half it was harmful; sea-water and medicinal springs. Clothes must be clean, dirty ones caused skin-diseases; it was advisable to carry a stick and to wear a head dress and shoes. Wearing garlands, ornaments and jewels strengthened the vital power and warded off evil spirits.

4. Regulation of sexual intercourse (milk was to be drunk after it); forbidden on the 8th, 14th and 15th days of the month and in the morning.

5. Prophylactic measures: an emetic once a week, laxative once a month, twice a year venesection. (C.S. 1).

Besides the regimen of life, another factor which played a great part in the production of disease is diet. The different constituents of the body grow when articles of food having similar attributes or constituents are taken and they become attenuated when articles having opposite qualities are taken. We have discussed in the chapter on materia medica the effect of drugs on the body and how this effect is dependent on the composition of the drugs, their taste, *vipāka* and *vīrya*. There is no sharp line of demarcation between drugs and articles of food. The latter have the same composition as the former and also possess taste (*rasa*), *vipāka*, and *vīrya* (potency). Charaka and Susruta discuss at great length the composition, the taste (*rasa*), *vipāka* (taste after digestion) and *vīrya* (potency) of all articles of food. Charaka divides these into twelve groups

and discusses their composition, tastes, potencies and assimilation. (C.S. 1. 25-28). Articles of food produce diseases by upsetting the balance of the *doṣas*. *Vāyu* is aggravated by partaking of too much bitter, pungent, astringent or dry food, by very light food, by dry meat, and by the continual use of some kinds of pulse and rice. *Pitta* is aggravated by partaking of too much bitter, acid, salty and dry food and by too much use of sesamum, mustard, sesamum and linseed oil, fish, mutton, certain greasy leafy vegetables, wines, curd, whey, etc. *Kapha* is aggravated by partaking of too much sweet, acid, salty, cooling and oily food, by heavy food and by excessive use of milk, curds, sugar, fats, wheat cakes, sweet fruits, meat of aquatic animals, etc. (C.S. 1. 20).

Besides articles of diet, the seasons of the year have also an effect on the *doṣas*. Among the three causes of disease we noticed, the climatic characteristics of heat and cold of the various seasons was one. The dietetic regulations varied naturally with the season, and great attention was paid to climatic conditions. The modifications which the dietetic regulations undergo according to the change of season were called *ṛtucharya*. Charaka divides the year into six seasons, *hemanta*, *sisira*, *vasanta*, *grīṣma*, *varṣa* and *sarad*. *Hemanta* (the cold season) lasts from 15th November to 15th January; *sisira* (the season of dew) from 15th January to 15th March; *vasanta* (the spring or the season of flowers) from 15th March to 15th May; *grīṣma* (summer) from 15th May to 15th July; *varṣa* (the rainy season) from 15th July to 15th September; and *sarad* (autumn) from 15th September to 15th November. *Vāyu* is naturally aggravated in the cold and rainy seasons, and specially in cloudy and stormy days. *Pitta* is naturally aggravated in the summer and autumn. *Kapha* is naturally aggravated in the winter and spring.

Under *ṛtucharya* Charaka describes the dietetic regulations to be followed in the various seasons. In *hemanta* one should eat fat, sour and salt sauce, flesh of watery and marshy animals, goats, etc. because cold increases the digestive power which enables one to digest heavy and rich food. One should take liquor, milk preparations, sweets, fats, oils, new rice and hot water. He also recommends the use of ointments, massage, anointing the head with oil, staying in a warm room, in the sunshine, in a warm underground place or an inner room, etc.

Similar rules are given for *sisira* (15th January to 15th March). Only one should look for a still better and warmer room protected from the wind, and avoid pungent, light, cold and similar

food and drink. In both these cold seasons man is at his best in strength.

In *vasanta* (spring, 15th March to 15th May) the accumulated *kapha* provokes many diseases ; therefore emetics etc. should be taken and heavy, sour, oily and sweet food, as well as sleep by day should be avoided. Exercise, massage, inhalations, water-gargling, ointment, washing, and bathing in cold water are likewise recommended. As for food and drink, barley and wheat and the flesh of the stag, hare, antelope and quail and certain kinds of liquor are recommended.

In *grīṣma* (summer, 15th May to 15th July) one should eat tasty, cold, fluid, oily things, cold preparations of barley with milk and sugar, flesh of deer, ghee, milk and rice. Spirituous drinks should be taken only in small quantities or not at all or mixed with plenty of water. Salt, sour, pungent and hot things, as well as physical exercise, cohabitation and sleeping by day in a cool place should be avoided. At night one should sleep in a place which has been cooled by rays of the moon, particularly on the windy roof of the house, should anoint oneself with cooling sandal-ointment, etc.

In *varṣa* (rainy season, 15th July to 15th September) the digestive system is weakened ; therefore, one should keep to a diet, should avoid sleeping by day, physical exercise, cohabitation, sun-heat, etc., should eat barley, wheat and old rice with flesh of deer and boiled sauce, and drink medicinal liquor in small doses with honey, rain-water or boiled water. Massage, baths, residence in dry places, etc., are also advised. In summer and in the rainy season man is at his weakest.

In *sarad* (autumn, 15th September to 15th November) one should eat in moderate quantity things which are sweet, light, cold, bitter and deficient in *pitta*, as well as flesh of deer, rice, barley and wheat ; should use pure water from a spring, for washing, drinking and bathing, avoid bitter drinks, ghee, purgatives, blood-letting, fat and oil, and keep out of the east wind (C.S. 1. 6).

The different practices laid down for the different seasons should be slightly modified for persons of particular constitutions. A person in whose constitution *vāyu* predominates should in every season indulge only in such food, drink and practices as keep the *vāyu* in a proper state, without exciting it at all. In the same way, one, in whose constitution *pitta* or *kapha* predominates, should confine himself to such indulgences as do not excite these *doṣas*. The substances which excite *vāta*, *pitta* and *kapha* have already been listed in the chapter on aetiology.

Ayurveda, the science of life, comprehends not only the health of the body but also of the mind. Body and mind are regarded as provinces in which health and disease co-inhere; parity of correlation being the cause of health. Charaka, when speaking of life, always includes both body and mind in it, and it is the health of both that is the chief concern of the physician. Physical diseases are to be cured by medicines, while mental diseases are to be cured by right and proper knowledge, self control and self-concentration. For this purpose he recommends the necessity of controlling certain mental and bodily tendencies. He forbids people to indulge rashly in their unthinking tendencies, to commit mistakes of mind, speech and action. A man should also control his passion of greed and his feelings of grief, anger, fear, vanity, shamelessness, envy, attachment and solitude. He should not speak harshly or talk too much or use stinging words or lie or speak irrelevantly or untimely. He should not injure others by his body, indulge in unrestricted sex-gratification, or steal. The man who follows the above right course of life is called virtuous, and enjoys wealth, satisfies his desires, abides by the laws (*dharma*) of a good life, and is happy. Charaka further advises that one should not keep company with those who are sinful in character, speech and mind, or who are quarrelsome, greedy, jealous, crooked, light-minded, or fond of speaking ill of others or cruel or who are vicious or who associate with one's enemies. One should associate with those who are wise, learned and aged, with men of character, firmness, self-concentration and ready experience, with those who know the nature of things and are full of equanimity, and those who direct us in the right path, are good to all beings, possess a settled character and are peaceful and self-contented. In these ways a man should try, on the one hand, to secure himself against the inrush of mental troubles which upset one's moral life and on the other hand, to attend properly to his bodily welfare by taking the proper kind of food at the proper time and also to attend to other details of physical well-being. Then he lays down the rules of good conduct (*sadvṛtta*) in great detail. Most of these have already been mentioned in the vow taken by the initiate (C.S. 1-8).

Along with the proper and well-controlled exercises of the moral functions, Charaka advises one to take to well-controlled physical exercise (*vyāyāma*). When moderately performed, this gives lightness, power of work, steadiness (*sthairya*) and fortitude (C.S. I. 7. 30).

When healthy persons conduct themselves improperly in respect of diet and deportment, forgetting considerations of measure and

season, diseases are generated (C.S. I. 7. 43). Life has for its root beneficial practices. From contrary courses of practices result disease and death (C.S. III. 3. 41). Disease is *dhātu-vaiṣāmya* or disharmony of the constituent elements of the body (*dhātus*). The modes of restoring the constituent elements of the body to their normal state is the object of Āyurveda and also of treatment (C.S. I. 1. 52). A correct diagnosis is the foundation of rational treatment. The indications for treatment are derived from the diagnosis. Before commencing treatment the physician should ascertain whether the disease is curable or not.¹

From the point of view of treatment, diseases are divisible into two classes, curable and incurable. Curable diseases may again be regarded from three points of view, those that are capable of being cured by easy means, those that are curable by means neither easy nor difficult and lastly those that are curable by difficult means.

The characteristics of diseases that are easily curable are : the causes, premonitory indications and present symptoms are slight ; the derangement has no sympathy with the inducing causes of the disease, the derangement that has brought about the disease is not capable of being aggravated by the constitution of the patient ; the inducing derangement is not sympathetic with the virtue of the season in which the disease has appeared ; the treatment does not become difficult in consequence of the place where the disease occurs ; the part affected by the disease is one ; the disease is new ; the disease is free from violent symptoms ; the derangement that caused the disease is concerned with only one of the three *doṣas* ; the body is such as is capable of bearing all kinds of medicines, and lastly the four requisites are present. Such diseases are said to be easily curable (C.S. 1. 10, 12. 14).

The characteristics of diseases that are curable with difficulty are that the causes, premonitory indications, and present symptoms are neither slight nor very grave ; that any of these, that is, the season of the disease, its nature, and the character of those ingredients of the body which are known by the name of *dūṣya*, is sympathetic with the derangement that induces the disease ; that the disease appertains to an elderly woman, an old man or an infant ; that it is not characterised by excessively violent symptoms ; is such that it should be treated with the aid of operations by (surgical) instruments, by caustic alkali, or by fire ; that it is chronic ; that it affects some vital limb or some joint of the body or affects only one part ; that the four principal

requisites of treatment are wanting in some particular and the disease affects two parts ; that the disease is not very old, and lastly, that the disease has been induced by a double derangement ; such diseases should be known as curable with difficulty. Even diseases that are incurable, in consequence of the exhaustion of one's allotted period of life, may be kept in a suppressed state by means of regulated diet and proper nursing (C.S. 1. 10. 15-18).

When the disease is deeply ingrained (in the marrow and such other constituents of the body) when it affects many of the constituent parts, when it is attached to the vital limbs and joints of the body, when it manifests itself continuously, when it is chronic and very old, when it is born of the derangement of two of the three ingredients (of *vāta*, *pitta*, *kapha*) or of all the three, when it is beyond the operation of treatment, when it affects all the organs, when the patient is thoroughly cheerless and despairing, when the disease is characterised by a stupefaction of the mind, when it weakens all the organs (of knowledge and action), when it has reached the highest limit of aggravation and the patient has become entirely strengthless, and lastly, when it shows indications of the patient's dissolution, it should be regarded as one that should not be taken up for treatment (C.S. 1. 10. 19-21).

Charaka and Susruta describe the four requisites of successful treatment. These are the physician, the patient, medicines and the attendant on the patient. When the physician is well qualified and the other agents possess their necessary qualities, even severe diseases can be cured in a short time. A patient cannot get well without the aid of a physician, although he may have the three other requirements. A qualified physician alone can often cure a patient, just as a helmsman alone can take a boat across the water without the aid of rowers.

The physician should be learned in the *sāstras*, and have practical experience ; he should be capable of acting for himself, light-handed, pure, bold, furnished with implements and medicines, ready-witted, sensible, learned, industrious, truthful and religious.

The patient who has vitality, strength, and a curable disease, who can procure all articles necessary for treatment, who possesses self-control, and who is faithful and obedient to the physician, is said to possess the necessary qualities.²

The medicines which are grown in pure soil, collected on an auspicious day, and administered in proper doses and times, which are pleasing, and endowed with their proper colours, odours and

tastes, which can remove the disorders of the *doṣas*, and cure diseases, which do not cause injury when given under misapprehension, are said to possess their necessary qualities.

The attendants should be amiable, capable of preserving secrets, strong in body, and devoted to the care of the patient. They should carry out the orders of the physician and never be tired. (C.S. I. 34 and 1. 9).³

Treatment must be commenced as early as possible after ascertaining that the disease is curable. Diseases gather strength and penetrate the body deeper and become more and more difficult of cure if left untreated. Appearing at first in a subtle form, disease afterwards increases till, driving its roots deeply, it destroys the strength and cuts short the period of life of the patient. Hence, before the ailment is contracted, or while it is new, it should be counteracted with the aid of medicines. (C.S. I. 11. 59 and 64). Susruta describes six periods of treatment (*kārya-kālas*). In the first the *doṣas* are increased (*chaya*). In the second they are deranged (*prakopa*). In the third there is a spread of the deranged *doṣas* through the body (*prasāra*). The fourth period is the appearance of premonitory symptoms (*pūrva-rūpa*). The stage of the developed disease is the fifth period of treatment. When any disease opens out a part of the body and forms a sore it is the sixth period. Treatment must commence at the earliest possible stage (*chaya*) and if that is not possible at least in the stage of *prakopa* or *prasāra* or *pūrva-rūpa*. Charaka judges the seriousness of diseases from their seats. He describes three seats of disease, (*sākhā*) the external, the vital parts (middle), and the *koṣṭa*, the internal. The external seat called *sākhā* includes the skin and the *dhātus*, except *rasa*. The vital parts are the arms, brain and the like, the bone-joints of the different bones and the arteries and veins attached to them. Charaka considers that the disease is incurable if it affects the vital limbs and joints of the body. Diseases must be treated before they reach the second and third seats, i.e., before they reach the vital parts and *koṣṭa*. As long as the disease affects only the three or four first stages into which the food-juice or *rasa* of the organism is gradually transformed, blood, skin and flesh may be cured. If it reaches the subsequent stages of metabolism, the more vital and subtle transformations of *rasa*, namely the bones, marrow and semen, the disease is beyond cure. The diagnosis of disease in the various periods of treatment is based on the symptoms and has been described in the chapter on diagnosis.

Ascertaining through the symptoms that indicate the disturbance of the *doṣas*, the physician should treat diseases that are curable

with medicines, diet and conduct, each possessed of virtue contrary to the cause, to the disease or to both cause and disease, reflecting the while upon the question of measure and time (C.S. I. 7. 42).

Charaka describes in a general way the principles underlying treatment. "We treat patients suffering from particular diseases with medicines possessed of virtues opposed to their symptoms. One whose *doṣas* have been dried up is treated with drugs possessing opposite virtues. A lean and weak man is fattened and strengthened. A corpulent and fatty person we reduce to proper dimensions. One whose system has become warm, we treat with drugs that are cooling. One whose system has become abnormally cool, we treat with drugs possessed of warming virtues. When particular ingredients of one's body become diminished, we restore them to their proper measure. When particular ingredients increase into abnormal proportions, we reduce them to their normal measure. In fact, by treating diseases with medicines endued with virtues opposed to their originating causes, we succeed in fully restoring the patients to their normal condition." (C.S. I. 10. 7).

Charaka describes six processes which, as methods of treatment, are sufficient for all diseases. If considerations of measure and time be observed, they prove successful in the cure of all curable diseases. These six processes include the five procedures described as *pañchakarman*. They are *vamana* or the use of emetics, *virechan* or the use of purgatives, *siro-virechan* or the use of errhines to promote nasal secretions, *āsthāpan* (dry enematas) and *anuvāsan* (oily enematas) known collectively as *vastikarma* which comprise the various forms of enemata and *rakta mokshana* or blood-letting. The six processes described by Charaka are *langhana*, *brimhana*, *rūkshana*, *snehana*, *swedana* and *sthambana*. (C.S. I. 22. 2-3).

Anything that lightens or attenuates the aggravated *dhātus* and *doṣas* is called a *langhana*. That which promotes nutrition and puts on weight is known as *brimhana*. That which brings about dryness, roughness and paleness of the body is called *rūkshana*. That which leads to secretions of oily matter, softness of the body and increase of impurities is called *snehana*. Anything that produces perspiration and destroys stiffness and heaviness and sensation of cold is called *swedana*. That which constipates or stops the motion of such constituents of the body as are liquid and restless and endued with motion is called *sthambana*. The four kinds of corrective process: administration of emetics, of purgatives, of errhines or cerebral purgatives and dry enemata, as also the bearing of thirst, and winds and the heat of the sun, drinking

of medicines called *pāchana*, fasts, and physical exercise, are included under *langhana*.

Those persons that have *kapha* and *pitta*, as also blood and impurities in excess, and those that have their *vāyu* in an excited or disordered condition, as also those that have large bodies or excessive strength, are fit for *langhana* through the four kinds of corrective processes included therein.

Those that have lost their vitality, have received wounds, are lean and emaciated, are cold or weak, or that walk long distances every day, are said to require *brimhana*. Baths, gentle rubbing of the body with medicated oils, sleep, honey and other sweets, oily enemata, sugar, milk and ghee are *brimhanas* for all persons.

Those diseases which are characterised by excess of secretions, those which are caused by violent excitement of the *doṣas*, that have their seats in the vital parts of the body, rheumatism of the thigh and such other afflictions, require the administration of *rūkshanas*.

Such things as are liquid, subtle, stable, oily, slimy, heavy, cooling, not pungent or mild, and soft are generally regarded as *snehana*.

Oils were used extensively in the treatment of diseases. Charaka mentions twenty ways in which they are used in medicine. They may be taken as an article of diet, as a vehicle of medicines, as an inunction, and also with enemata or with those drugs that are used after the application of enemata, or with liquids injected into the ear, or with snuffs or with washes or collyria for the eyes. People who are constantly exposed to the wind and the sun; whose constitutions are dry; who have been reduced by bearing heavy burdens or excessive walking; whose vital seed or blood has been dried up; whose phlegm and fat have been reduced; whose bones, joints, nerves, sinews, vitals and stomach have much pain; whose ducts and other hollow parts of the body are filled with aggravated *vāyu* require the administration of *snehanas*. (C.S. I. 22. 4. 40).

Like *snehana*, *swedana* was also extensively employed in treatment. Charaka describes thirteen kinds of *swedas* and their indications and contra-indications and the diseases in which they may be utilised. *Sweda* was regarded as beneficial in the following diseases: catarrh, phthisis, hiccups, asthma, heaviness of the limbs, otalgia, wry neck, headache, hoarseness of voice, choking up of the voice, facial paralysis, paralysis of a particular limb or of the whole body, spasms and contortions of the body, suppression of stools and urine, obstruction in the flow of vital seed, pains in any part of the body, swellings or intumescence, diseases

of the stomach, stiffness of the limbs, heaviness of limbs, and loss of sensation of touch. (C.S. I. 14. 2. 23).

Besides a general description of these processes, Charaka indicates their use in treating the diseases due to the derangement of *doṣas*. Diseases of *vāyu* should be treated with the aid of medicines that are sweet or sour or saltish or that are cool or warm. Taking into consideration also the measure and time, the other expedients to be employed are the administration of *sweda*, oils, enemata, oily enemata, cerebral purgatives, rubbing with medicated oils, application of unguents, baths, including pouring and sprinkling of medicated waters, and such other expedients as are destructive of the *vāyu*. Amongst these, the use of enemata of both kinds, dry and oily, is regarded by physicians as the foremost of all expedients in treating diseases of *vāyu*.

Diseases caused by disorders of bile (*pitta*) should be treated by administration of such agents as are sweet, bitter or astringent to the taste, or such as are cooling. In treating them, use should also be made of oils, purgatives, unguents, fomentations, medicinal oils for rubbing and such other operations and processes as are destructive of bile (*pitta*). Physicians, however, regard purgatives as the foremost of all agents in the treatment of diseases of bile (*pitta*).

The diseases of the phlegm (*kapha*) should be treated with such agents as are pungent, bitter, astringent, keen, warm and dry. In treating them, use should be made of *swedana*, emetics, errhines, physical exercise and similar other means that are destructive of phlegm (*kapha*). Of all these means, physicians regard the use of emetics, settling the measure and the time thereof, as the foremost in point of efficiency. (C.S. I. 20).

When disorders occur, the five operations mentioned above (*panchakarman*) should be utilised after use of emollients (*snehana*) and diaphoretics (*swedana*), upon consideration of dose and time; and success depends upon right application.

Susruta, as we have seen in Chapter VI, divides medicines into two classes with reference to their action on the *doṣas*, *samsamana* and *samsodhana*. The *samsamana* class is comprised of medicines which rectify the deranged state of *doṣas* and calm their excitement without promoting the excretions. The group is divided into three sub-groups, medicines influencing *vāyu* (*vāta samsamana*), those influencing *pitta* (*pitta samsamana*) and those that influence *kapha* (*śleshma samsamana*). The *samsodhana* class is comprised of medicines which remove collections of deranged *doṣas* and discharge them through the excretions. The *samsamana* group of drugs "suppress" the disordered *doṣas* and

the *samsodhana* group "clear up" the accumulated *doṣas*. Accordingly, two kinds of treatment were recognized, "the putting down" (*samsamana*) and the "clearing up" (*samsodhana*). The *samsamana* treatment is useful in the treatment of the early stages of *dhātu-vaiṣamyā*, i.e., disharmony of the *dhātus*. Charaka describes in detail these two kinds of treatment and their indications. He divides treatment into two kinds, *santarpana* and *apatarpana*. *Santarpana* is the prescribing of food and practices that have a soothing and nutritive effect on the system. *Apatarpana* is a course of treatment that dries up the *doṣas*. Certain diseases were recognised as produced by over-indulgence in sedative and nutritive food and practices. Certain others were produced by rigorous abstinence from such kind of food and practices. So, for all diseases generated by *apatarpana*, there is no alleviation without *purana* or *santarpana*; as for diseases generated by *purana* or *santarpana*, there is no alleviation without *apatarpana*.

Apatarpana is of three kinds: (1) *langhana*; (2) *langhana-pāchana*; and (3) *doṣāvasechana*.

Of these, *langhana* is to be used for *doṣas* slightly provoked. A *doṣa* slightly provoked and of little strength becomes dried up through the increase of digestive fire and of *vāyu* brought about by *langhana*, just as a shallow pool is dried up by heat and wind.

A *doṣa* that is provoked a little more than what would be called slight and that possesses medium strength is dried up by the administration of both *langhana* and *pāchana*, just as a slightly larger pool is dried up by the wind and the rays of the sun, as also by dust and ashes falling upon it. *Pāchana* are medicines which digest undigested food without increasing the appetite.

In cases where the *doṣas* have been excited to a great degree it is necessary to drain them out. This process is called *avasechana*. The means adopted for this purpose are the administration of correctives such as emetics and purgatives and the application of *swedana* and *snehana*.

Of these three kinds of treatment, *langhana* and *langhana-pāchana* come under the heading of *samsamana* and *doṣāvasechana* under that of *samsodhana*. (C.S. III. 3. 57-62).

In the treatment of diseases regimen of life and diet were considered at least of equal importance with drugs and more strictly therapeutic measures. The purposeful regulation of diet and digestion always preceded the more directly remedial measures, and even among them the purposeful regulation of diet played no small part. Though the physician was advised not to undertake the treatment of incurable cases, such patients were not entirely

abandoned. Charaka writes "even diseases that are incurable, in consequence of the exhaustion of one's allotted period of life, may be kept in a suppressed state by means of regulated diet and proper nursing."

When the *dhātus* become disordered, it is generally seen that three kinds of medicines, all of them to be brought into contact with the body, become necessary: (1) those for internal application; (2) those for external application; and (3) the use of surgery. Surgical treatment was reserved for those diseases which do not come entirely under the category of medical treatment. When diseases appear, the wise man dispels them and recovers health by the use of external or internal medicines or by surgery. (C.S. I. 11. 55-57). The surgical operations are: incision, excision, scarification, puncture, probing, extraction, drainage or evacuation of fluids and suturing. Charaka considers diseases which require treatment by instruments and caustics to be curable with difficulty. (C.S. I. 10. 15-18).

One other point with regard to treatment must be mentioned. We have discussed above the treatment of diseases produced by the disharmony of one or more *doṣas*. For the sake of expediency only it is laid down that there are three separate *doṣas*. However, they may occur in an infinite variety of combinations, since the distinctions of variety are innumerable. (C.S. III. 1.6). In consequence of this, the methods of treatment also must be combined.

We have so far considered the treatment of diseases produced by the *doṣas* of the body, *vāyu*, *pitta* and *kapha*. Besides these, there are others produced by the *doṣas* of the mind *rajas* (passion) and *tamas* (darkness). When these are disordered, mental diseases are produced. Charaka recognises three varieties of mental disease: those produced by the disorders of the bodily *doṣas*, those produced by the mental *doṣas*, and those produced by a combination of the two. Thus Charaka classified five types of insanity: *vāyu*-born, *pitta*-born, *kapha*-born, that born of all the three *doṣas* and that which is accidental. With regard to the accidental variety he remarks that some say that it is caused by the evil acts of previous lives, but Punarvasu considers it as due to faulty judgment. The person afflicted with this variety of insanity does evil by disregarding the deities, the Rishis, the Pitris and others deserving of worship, or commits other sinful acts of this kind. The afflicting deities and others make such a person, already afflicted himself, insane. A good physician should undertake the treatment of the types of insanity produced by the bodily *doṣas* according to the methods laid down, as they are curable.

The other variety called accidental is characterised by incubatory indications and symptoms differing from those produced by bodily *doṣas* and is incurable.

These two varieties sometimes run into each other or become blended in consequence of the union of their causes. When, however, the accidental variety supervenes on any of the constitutional varieties, these should be treated with medicines that depend for their action upon the deities and invisible influences. Among these are mantras, herbs, and plants of invisible virtue, gems, auspicious rites, sacrifices, expiatory ceremonies and other rites, fasts etc. The disharmony of the *doṣas* of the body is to be treated in the rational way and the derangement of the mental *doṣas* by mantras and other theurgic practices, i.e., in a supernatural way. (C.S. II. 7 and C.S. VI. 9)

After ascertaining the disturbance of the *doṣas* from the symptoms of the disease, one should treat such diseases as are curable with medicine, diet, and practices possessed of virtues contrary to the cause, to the disease or to both cause and disease. Here Charaka speaks of treating not only the symptoms of the disease but also the cause by contraries. This treatment by contraries is of three kinds : (1) treatment by measures which are contrary to the causes of the disease and which operate for its removal (*hetu-vipareetham*) ; (2) treatment by measures which are contrary to the manifestations of the disease and operate for their removal (*vyadhi-vipareetham*) ; (3) treatment by measures which are contrary to both cause and the symptoms of the disease and operate for their removal (*hetu-vyadhi vipareetham*).

Charaka mentions another kind of treatment which is by the use of such medicines, diet and practices as, without being actually contrary to cause and disease, lead to recovery or cure. This is called *vipareeta-arthakārinam*. The fruits of *randia dumetorum* are prescribed in nausea and vomiting. These have emetic properties. If administered in small doses, they check nausea and vomiting. Hence without being contrary to the disease, they produce contrary effects, and thereby lead to recovery. An example of food which, without being contrary to the disease, produces contrary effects is milk in diarrhoea. Milk is calculated to increase diarrhoea, but administered in regulated measure to patients suffering from diarrhoea of certain kinds, it does great good and cures the disease. This method of treatment may be called the treatment by similars.

CHAPTER VIII

SURGERY IN ANCIENT INDIA

Salya is the name applied to the art of surgery in Indian medicine and is derived from the root *sal* or *sval* meaning to move quickly. Foreign bodies of every kind are denoted as *salya*, but it specially refers to the arrow, which was the commonest and most dangerous foreign body causing wounds and requiring surgical treatment. A *salya* usually acts as an impeding or obstructing agent to the entire organism and hence the science which deals with its nature and characteristics is called *Salya-tantra* or *sastra* (surgery). (S.S. 1. 26. 3).

A primitive sort of surgery is as old as warfare. The Āryan invaders of India had to wage fierce war with the inhabitants of the Indus valley before they conquered them. During the wars surgeons were frequently requisitioned to attend on the wounded. Thus in the Rigveda we read of the amputations of legs and the fitting with artificial limbs, enucleation of eyes, and extraction of arrow shafts from the limbs of the wounded. We read of the famous surgeons to the gods, the Asvini Kumaras. Dhanvantari recites an incident which occurred in one of the wars of the gods. Rudra cut off the head of Daksha. Then the gods called on the twins to repair the damage and they successfully united the head to the trunk and restored Daksha to life.

In classical times surgery (*salya*) was regarded as the most important branch of medicine. In the mythical Āyurveda itself it is accorded the first place and heads the eight divisions of medicine. From the very beginning, as we have seen, two schools of medicine have been recognised, that of Ātreya, of medicine proper, and that of Dhanvantari, of surgery; and all subsequent development kept to this division. Dhanvantari, introducing Susruta to the art of surgery, says: "This *salya-tantra* is considered the most important of the eight divisions, on account of the cures effected by it being rapid and striking, on account of its teaching the use of blunt instruments, cutting instruments, caustics, cautery, etc., and its principles being applicable to all other sections. Hence this portion of the Āyurveda is eternal and holy, and the means of attaining heaven, fame, longevity

and wealth." Surgery was divided into two divisions, *salya* and *sālākya*. Their scope is defined as follows : *salya* treats of the extraction of external substances accidentally introduced into the body, such as grass, wood, stones, earth, iron, fragments of bricks, bones, hair, nails, and arrows ; of pus and retained secretions, and of the foetus from within the womb. It teaches also the use of blunt instruments, cutting instruments, caustics and the actual cautery, together with the diagnosis and treatment of inflammation. *Sālākya* treats of diseases of the ears, eyes, mouth, nose, and other parts of the body above the clavicle. (S.S. 1. 1).

"Associated primarily with warfare, surgery for a long time remained a special branch, distinct from the civil science of longevity (*Āyurveda*). It needed a particular effort, a stroke of genius, to break down the barriers of traditional specialization and to merge surgery with the science of macrobiotics. This step is accomplished through the work of Susruta. In Susruta's *samhita*, surgery achieved a leading position as an indispensable element of general medical training. And one may say that his emphatic statement of its incomparable value for a correct understanding of anatomy reflects a triumph in the evolution of Indian medicine. A fruitful union of what traditionalism had formerly held apart is here effected."¹ "He who has observed the internal mechanism of the human body is well read in the works bearing on these subjects and has thus all his doubts expelled from his mind is alone qualified in the science of *Āyurveda* and has a rightful claim to practise the art of healing." (S.S. 111. 5. 57). "This accurate account of the parts of the body, extending as far as the skin, is not to be found in any other part of medical teaching, but only in the doctrine of surgery. Therefore the surgeon in seeking a thoroughly reliable knowledge must duly prepare a dead body and carefully ascertain its parts. For by putting together what he perceives with his own eyes with what he has learned from valid tradition through text-books, he will increase his wisdom." (S.S. iii. 5. 49).

We have already noticed the training which a physician had to undergo. We have seen that he had to learn both surgery and medicine. We have also seen the particular emphasis that Susruta laid on the practical training of a surgeon. "The physician who is only learned in the *sastras*, but is unacquainted with the practical methods of treatment, and the one who knows the practical details of treatment but from self-confidence does not study the *sastras*, are unfit to practise their calling : such persons deserve to be killed by the king." (S.S. 1. 4). After having

studied the sastras and learnt their meaning, after having attained proficiency in reciting the sastras and obtained a practical knowledge of surgical treatment, the physician should obtain the permission of the king and commence his practice. Anatomy, though assigned first rank as a means of investigating the structure of the organism, evidently proved of no great avail in the practice of surgery. It is not clear whether dissections formed a part of the training of a surgeon. Susruta does not mention them in this connection. The method of dissection followed was too imperfect to give any accurate knowledge of the internal organs and of the vascular system of the body so essential for any scientific surgery. The Indian surgeons surmounted the absence of such precise knowledge of anatomy by the concept of *marmas*, which supplied them with the regional anatomy so crucial for any intelligent surgery.

"Firm unions of *māmsa* (muscles), *sirā* (vessels), *snāyu* (ligaments), *asthi* (bones) or *santhi* (bone-joints) are called *marmas* or vital parts of the body, and these naturally and specifically form the seats of life (*prāna*)."
(S.S. iii. 6. 22). The medical authorities have described the *marmas* as covering half the scope of *salya-tantra* (surgery), inasmuch as a person injured in any of the *marmas* dies shortly (i.e., within seven days of the injury). A deformity of the organ is sure to result from any injury to one of these *marmas*, even if death be averted by a course of judicious and skilful medical treatment."
(S.S. iii. 6. 83).

The *marmas* are 107 in number and are classified into five groups: (1) *Māmsa-marmas* (of the fleshy parts) 11; (2) *Sirā-marmas* (of the vessels) 41; (3) *Snāyu-marmas* (of ligament unions) 27; (4) *Asthi-marmas* (bone unions) 8; (5) *Sandhi-marmas* (vulnerable joints) 20. (S.S. iii. 6. 2).

Of the 107, 11 are in each leg, thus making 22 in the lower extremities; the same number is found in the upper extremities; thus there are 44 *marmas* in the four extremities. There are 12 in the region of the chest and the abdomen (*udhara*). There are 14 in the region of the back and 37 in the region of the neck (*grīva*) and above it. (S.S. iii. 6. 4).

The *marmas* are divided into five groups on the basis of the seriousness of injury to them: (1) *Sadya-prānahara* or fatal in seven days; (2) *Kālāntara-prānahara* or fatal within a fortnight or a month; (3) *Visalyaghna* or fatal as soon as a dart or any other imbedded foreign body is extracted therefrom; (4) *Vaikalpyakara* or maiming or deforming; (5) *Rujākara* or painful. (S.S. iii. 6. 16-21).

Classification of the *marmas* under the above headings :

MARMAS OF THE UPPER AND LOWER EXTREMITIES (44)

<i>Name of the marma</i>	<i>Variety & Number</i>	<i>Location</i>	<i>Result of injury</i>
1. Kṣipram	Snāyu M. 4	Between the great toe and the other toes	Death from convulsions or paroxysms
2. Talahrdaya	Māmsa M. 4	In the line of the middle toe and across the middle of the plantar surface of the foot	Death from pain
3. Kūrçham	Snāyu M. 4	Above the Kṣipram on both sides	Eversion or inversion of foot and tremors
4. Kūrçhasira	Snāyu M. 4	Below the ankle joint on both sides	Swelling and pain
5. Gulpha	Sandhi M. 2	The junction between the foot and the leg ; Ankle	Pain, inability to move the foot or shortening of the limb
6. Indravasti	Māmsa M. 4	Towards the heel, in the middle of the calf	Death from loss of blood
7. Jānu	Sandhi M. 2	The knee joint. Junction between the leg and the thigh	Lameness
8. Ani	Snāyu M. 4	Three angulas (fingers) above the knee joint on both sides	Loss of movement of the thighs and great swelling
9. Urvi	Sirā M. 4	In the middle of the thigh	Wasting of the thigh from loss of blood

<i>Name of the marma</i>	<i>Variety & Number</i>	<i>Location</i>	<i>Result of injury</i>
10. Lohitākṣam	Sirā M. 4	At the upper end of urvi and below the groin at the base of the thigh	Death from loss of blood or paralysis of the limb
11. Vitapam	Snāyu M. 2	Between the scrotum and the groin	Loss of sexual capacity

N.B. In the arms instead of the ankle (gulpha), the knee (Jānu), and the Vitapa of the leg we have the wrist (manibandha), the elbow (kūrpa) and the Kakshadra (between the axilla and the clavicle) respectively.

Kakshadra	Snāyu M. 2	Between the axilla and the clavicle
Manibandha	Sandhi M. 2	The wrist joint
Kūrpa	Sandhi M. 2	The elbow joint

MARMAS OF THE TRUNK (12)

1. Guda	Māmsa M. 1	The part attached to the large intestine and through which flatus and faeces are voided	Death within seven days
2. Basti	Snāyu M. 1	The hollow viscus situated in the pelvis and having little muscle and vascularity and in which urine collects	Death within seven days except in surgical incision for the removal of calculus

<i>Name of the marma</i>	<i>Variety & Number</i>	<i>Location</i>	<i>Result of injury</i>
3. Nābhi	Sirā M. 1	Situated between the stomach and the intestines and having many vessels	Death within seven days
4. Hṛdayam	Sirā M. 1	Midway between the breasts inside the chest and where the entrance to the stomach is	Death within seven days
5. Stanamulam	Sirā M. 2	Two angulas below the breasts on the lateral side of the chest	Cough, and difficulty of breathing or suppuration and eventual death
6. Stanārchitam	Māmsa M. 2	Above the level of the nipples and two angulas laterally on both sides	The joints are filled with internal haemorrhage; death due to cough and difficulty of breathing
7. Apalāpa	Sirā M. 2	Below the shoulder joint and at the upper part of the lateral side. The axilla	Death from pus formation of the blood
8. Āpastambha	Sirā M. 2	Air-carrying tubes on both sides of the chest	Death from air in the koṣṭha, cough and difficulty of breathing

MARMAS OF THE BACK (14)

<i>Name of the marma</i>	<i>Variety & Number</i>	<i>Location</i>	<i>Result of injury</i>
1. Katikatarunam	Asti M. 2	At the sides of the spine where the crest of the pelvic bones joins the spine	Death by pallor from loss of blood and paralysis of the limb
2. Kakundram	Sandhi M. 2	On the side of the back of buttock abutting the sides of the spine	Loss of sensation and paralysis of lower limb
3. Nithamba	Asti M. 2	The posterior of the abdomen lateral to the spine and above the ilio-sacral joint	Death from withering and paralysis below the waist
4. Pārśvasandhi	Sirā M. 2	Below the region of the pelvis and on the border of the lesser pelvis in a line horizontal with it	Death from bleeding into the abdomen
5. Br̥hati	Sirā M. 2	Below the level of the breasts and going straight towards the spine	Death from bleeding
6. Amsaphalaka	Asti M. 2	Shoulder blades; on the upper portion of them	Loss of sensation and wasting of the arm
7. Amsam	Snāyu M. 2	Between the shoulder, head and neck extending between the axilla and the neck	Inability to move the upper limb

MARMAS ABOVE THE LEVEL OF THE CLAVICLE (37)

<i>Name of the marma</i>	<i>Variety & Number</i>	<i>Location</i>	<i>Result of injury</i>
1. Nilā-manyā	Sirā M. 4	On both sides of the wind- pipe or the trachea	Loss of power of speech, hoarseness and loss of sense of taste
2. Matrka	Sirā 8	On each side of the neck	Death within seven days
3. Krikatika	Sandhi M. 2	At the junction of the head and neck	Free movement of the head on the neck or inability to keep the head erect
4. Vidhuram	Snāyu M. 2	At the root of the back of the ear	Deafness
5. Phana	Sirā M. 2	Situated inside the nose at both sides	Loss of sense of smell
6. Apāngam	Sirā M. 2	Below the outer end of the eye-brow, at the outer end of the eye	Loss of sight or impairment of vision
7. Āvartam	Sandhi M. 2	About the depression above the eye-brow	Blindness more or less com- plete
8. Sankha	Asti M. 2	Above the level of the outer end of the eye-brow mid- way between the brow and the ear	Death within seven days

<i>Name of the marma</i>	<i>Variety & Number</i>	<i>Location</i>	<i>Result of injury</i>
9. Utkṣepam	Snāyu M. 2	The spot above the temples at the border of the hairy portion	Foreign body lodged therein, life is safe as long as the splinter is allowed to remain or allowed to come out of itself. Otherwise death may result if splinter is removed
10. Sthapani	Sirā M. 1	Between the eye-brows at the root of the nose	Results same as above
11. Simanta	Sandhi M. 5	The five sutures of the cranium	Causes mental excitement, fear, loss of intellect and death
12. Sringātaka	Sandhi M. 4	On the upper and posterior wall of the pharynx where the four passages from the mouth, the ear, the nose and the eye meet	Instant death
13. Adhipati	Sandhi M. 1	Within the skull and above its floor at the places where the sirās meet at about the level of the hair-whorl at the back of the head	Death within

Susruta gives detailed instructions as to the sites at which incisions are to be made in connection with some of the important *marmas*. An incision should be made at the spot of a finger's width remote from the *urvi*, *kūrcha-sirā*, *vitapa*, *kakṣa* and *pārsva-marma*; whereas, a clear space of two fingers from it should be left in making any incision about the *stanamula*, *manibandha* or *gulpha-marma*. Similarly a space of three fingers should be left from the *hṛdaya*, *vasti*, *kūrcha*, *guda* or *nābhi marma*; and a space of four fingers from the four *śringātakas*, five *śīmanthas*, and ten *marmas* of the neck; a space of half a finger is the rule with the remaining 56. Men versed in the science of surgery have laid down the rule that, in a surgical operation, the situation and dimension of each local *marma* should be first taken into account and the incision made in a way so as not to affect it, inasmuch as an incision which extends or affects the edge or side of the *marma* in the least may prove fatal. Hence all the *marma-sthānas* should be carefully avoided in a surgical operation. (S.S. III. 6. 81).

A *marma* is a junction or meeting place of the five organic structures, that is, of ligaments, blood vessels, muscles, bones and joints. Susruta thus explains the result of injury to the various *marmas* and links it to the *tri-dhātu* theory. The *marmas* belonging to the *sadya-prāṇahara* group are possessed of fiery virtues; as these are easily enfeebled, they prove fatal to life (in the event of being injured in any way). Those belonging to the *kālāntara-prāṇahara* group are fiery and lunar (cool) in their properties; and as the fiery virtues are enfeebled easily and the cooling virtues only after a considerable time, the *marmas* of this group prove fatal in the long run (in the event of being injured in any way), if not instantaneously like the preceding ones. The *visalyaghna marmas* are possessed of *vātaja* properties (i.e., they arrest the escape of the vital *vāyu*); so long as the dart does not allow the *vāyu* to escape from the injured interior, life is prolonged; but as soon as the dart is extricated, the *vāyu* escapes from inside the injury and this necessarily proves fatal. The *vaikalyakaras* are possessed of *saumya* (lunar properties) and they retain the vital fluid owing to their steady and cooling virtues; hence they tend only to deform the organism in the event of being hurt, instead of bringing on death. The *rujākara marmas* of fiery and *vātaja* properties become extremely painful when injured inasmuch as both of them are pain-generating in their properties. Others, on the contrary, hold the pain to be the result of the properties of the five material components of the body (*pancha-bhautika*). (S.S. iii 6. 23).

But this opinion was not universally held and some authorities tried to explain the effects of injury on *marmas* by the varying composition of the latter. Taking the five varieties of effects, some assert that *marmas*, which are the firm union of the above-mentioned five structures (ligaments, blood vessels, muscles, bones and joints) belong to the first group (*sadya-prānahara*) ; and that those which form the junction of four such, or in which there is one in smaller quantity, will prove fatal in the long run, if hurt or injured (*kālāntara-prānahara*). Those which are the junction of three such factors belong to the *visalya-prānahara* group ; those of two belong to the *vaikalyakara* group ; and those in which only one exists belong to the pain-generating type (*rujākara*). (S.S. iii. 6. 24-25).

There is no mystery about these *marmas*. From the results produced by injury it can easily be inferred that they are danger spots which surgery discovered during operations. They consist of arteries and veins, nerves, tendons and ligaments, and bones and joints. The thoracic and abdominal *marmas* include in addition the intestines, the bladder, and the ducts such as the ureters, seminal vesicles, fallopian tubes, etc. We have seen that the *marmas* are divided into 5 distinct groups : fatal in 24 hours, within a fortnight or a month, as soon as a dart or any other imbedded foreign matter is extracted, or maiming and deforming, or painful, according as an injury produced the aforesaid results. The *marmas* are arteries, veins, nerves, tendons, and ligaments. A clear knowledge of the anatomy of the vascular system, the nervous system, the muscles, their origin and insertions, the ducts and their courses, would have enlightened the surgeon as to what artery, vein, nerve or duct he is likely to meet during the course of his operation. As we have seen, this knowledge was lacking. Indian physicians since the time of Susruta were convinced that anatomy securely based on autopsy dissection is requisite for true medical knowledge. In practice, however, Indian anatomy was utterly unable to rise to the achievement one might have expected from the keen interest of surgeons in the structure of the human body. "The methodical dissection of a well preserved corpse after the manner of modern research and training was excluded by the tabus of religion in subtropical India. They had to have recourse to the most unsatisfactory method of dissection which was only possible under those conditions. The results to be gained by this sort of gently scrubbing asunder a soaked body on the verge of melting away, were exactly what one would expect from such an examination of an object, preserved and decomposing at the same

time ; an almost perfect osteology, based on the bony structure left intact for unlimited inspection ; a fair enumerative knowledge of the muscles, sinews and ligaments still sufficiently preserved ; but no real insight into the intricacies of the nervous system, the blood vessels, or into the exact course and purpose of the various canals and organs essential for metabolism." ² What anatomy was expected to supply and did not, left no option to the surgeon but to rely on his own experience. A knowledge of the anatomy and physiology of the nervous and vascular systems would have dispelled all the mystery surrounding the *marmas* and made the task of the surgeon less hazardous and dangerous and more certain. The concept of *marmas* is the crystallisation of the wide experiences gained by the surgeons of the dangers and hazards of inadvertently cutting vital structures like the arteries, veins, nerves, tendons and ligaments. What anatomy failed to do for him, he out of his own experience mapped out with his theory of the *marmas*, the danger spots of the body. It is this that made the surgery of ancient India possible and enabled it to attain such an eminent position among the ancient civilizations.

It has always been a matter of speculation how the ancients ever carried out major surgery in the absence of anaesthetics, haemostatics and antiseptics. "Surgical achievements are not inconsiderable among the primitive people ; considering the paucity of anatomical knowledge, the boldness of operations undertaken is surprising. Foreign bodies are extracted and abscesses opened with thorns or other sharp pointed objects ; in the treatment of wounds suction is employed, sometimes even a species of drainage by means of sections of bamboo ; suture or tight bandaging, to promote union, is not unknown amongst some tribes. Stitching of small wounds is carried out by means of thorns, which are used to transfix the edges of the incision, the ends being then wrapped round. Among some Indian tribes of Brazil it is customary to allow both edges of a wound to be seized by the sharp head-nippers of certain ants, whose bodies are then rapidly cut off ; one ant after another being used, the wound is closed. In the treatment of ulcers cauterisation with hot ashes, heated blades and irons are favourite methods. Arrest of haemorrhage presents great difficulties to aborigines ; for the most part they do not know how to attack it. It is sometimes brought about by means of vegetable and mineral styptics, less often it is attempted by means of circular pressure (tightly bound bandages). The treatment of dislocations is based upon no rational method, but we have astonishing reports of intelligence

with which fractures are set. Not only splints (of wood, bark and bamboo) are employed, but even immobilising apparatus, made of clay. Of operations the majority concern the sexual sphere. Circumcision, male and female; and the Mika operation (external urethrotomy from the orifice of the glans to the scrotum, in order to limit the progeny), the Caesarean section and ovariectomy, have all been performed by the primitive tribes.

"Cupping, blood-letting, in various forms were widespread methods of treatment. Scarification was performed with thorns. Venesection was performed upon various veins with splinters of stone or knives. The instruments used were bone tubes, oxen or buffalo-horns for cupping, thorns, fish-bones, splinters of stone, mussel-shells, pieces of bone and glass or knives for scarification, splinters of stone or knives mounted or unmounted were used for venesection. Trephining and scraping of hollow bones were undertaken. Intoxication or stupefaction by narcotics and by hypnotism are the necessary preliminaries for severe measures.

"The not infrequent successful outcome of such operations, done regardless of all antiseptic precautions, can only be explained by the supposition that the aboriginal races have a greater power of resistance against wound infection than highly civilized nations.

"Obstetrics, which lies almost exclusively in the hands of the women, shows a very variable stage of development in different races; thus among the Malays an attempt is made to rectify unfavourable positions of the foetus in utero, whilst in Cochin-China retained placenta is treated by trampling upon the abdomen."³

The above observations on the art of primitive surgery enable us to understand how the ancient Indians cultivated and perfected it within their available means and attained a very great proficiency in it. The range of their surgery was not wider than that of the primitives, but their methods were vastly improved, supplemented by newer knowledge and acquisitions. It is curious to note that no reference has been made in Indian surgical treatises to trephining. Susruta classifies surgical operations into eight different kinds: (1) excision (*bhedya*); (2) incision (*chhedya*); (3) scarification (*lekhya*); (4) puncture (*vedhya*); (5) probing (*eshya*); (6) extraction (*āharyā*); (7) Drainage or evacuation of fluids (*visrava*); and (8) suturing (*sīvya*). (S.S. I. 5. 4).

A surgeon called upon to perform any of the above operations should equip himself with such accessories as surgical appliances and instruments, viz., blunt instruments, cutting instruments,

caustics, cautery, probe, horn, leeches, bitter gourd, a tent or *bougie* made of black stone, cotton, pieces of cloth, thread, leaves, jute, honey, clarified butter, suet, milk, oil, emollient and astringent fluids, liniments, pastes, fan, cold water, hot water, iron pans, and steady, calm, able-bodied assistants.

Surgical operations should be performed on an auspicious lunar day, star, and moment, after worshipping or propitiating the god of fire, Brahmans and physicians with curdled milk, rice, drinks, and jewels, and after offering presents and blessings.

The patient should take some light food. He should then be seated with his face to the east and secured or restrained. The surgeon should sit with his face towards the west and take care not to injure any vital part (*marma*), vein, nerve, joint, bone or artery. The instrument should be introduced in the direction of the hairs of the skin, till pus is seen. It should then be quickly withdrawn. In large abscesses the incisions may be of the depth of one or two fingers breadth. In operations for malpresentations of the foetus, ascites, piles, calculus in the bladder, fistula-in-ano, and affections of the mouth, the patient should not take any food, but should undergo the operation on an empty stomach. After the operation the patient should be soothed with cold water. On the third day the bandage should be opened and re-applied. This should not be done in a hurry on the next day. (S.S. 1. 5). According to AS. 1. 38, AHR 1. 29, the patient should be given whatever he wishes to eat and wine to drink before the operation, so that he may not faint and may not feel the knife.

Susruta mentions three stages in the treatment of diseases : the preliminary measures (*pūrva-karma*), the principal therapeutic or surgical appliances (*pradhāna-karma*), and the after-measures (*paschāt-karma*). Great emphasis is laid on the after-treatment. (S.S. 1. 5).

It is to be noticed that in surgery animism is very prevalent. All operations are followed by the reading of preserving incantations or mantras for obviating the malice of the *krityas* (a sort of female deity) and *rakshas* and for the destruction of the *nagas*, *pisachas*, *gandharvas*, spirits of ancestors, *yakshas*, or *rakshasas*. This incantation ends with "May the god of fire protect your tongue; the god of air, your *prāṇavāyu*; the other gods, the other *vāyus*; the god of strength, Indra, your strength; Manu, the two tendons of your neck, etc.; Vishnu, your power; Narayana, your virility or manhood; Brahma, your soul; and the star Dhruva, your eyebrows. These deities are constantly present in your body. May they always protect you and may you attain

long life. May the moon, the sun, Narada, Agni, Vāyu, the attendant gods of Indra and Rakshas bless you. May Brahma and the other gods bless you. May your life be prolonged. May the causes of destruction of crops be at rest and may you be free from pain." (S.S. I. 5). Here we have the animism of the Atharva-veda in full blast. The surgeon has very little belief in the efficacy of his unaided art or of his skill. The patient and all his organs and functions are committed to the deities presiding over them.

Of the above-mentioned eight operations, excision is prescribed in fistula-in-ano, unripe growths caused by *kapha*, dark moles, edges of wounds, tumours, haemorrhoids, and similar growths (*charmakila*), foreign matter in the bones or flesh, hairy moles, fleshy growths (in the palate), swollen tonsils, ulcers on the penis (*ṣataponaka*), a red tumour on the palate (*adhruṣa*), abscesses on the penis or tumour over the wisdom-tooth.

Incisions are suited to deep-seated abscesses, growths, erysipelas, swelling of the testicles, abscess of the axilla, carbuncles, tumour (*sopha*), diseases of the mammary gland, pustule on the penis, cysts on the eyelids, ulcers on the foot, fistula, inflammation of the throat (*vṛnda* and *ekavṛnda*), ulcer of the penis (*pusparikā* and *alaṇī*), tumours on palate and teeth, abscess of the tonsils, hard tumour in the throat, and septic tumour or tumour originated from fat. The bladder is, on the contrary, to be opened only for stones.

The four curable kinds of *rohiṇī* (throat inflammation), leucoderma (*kilāsa*), a tumour on the gums originating from fat, growths, abscesses, tumours on the tongue, haemorrhoids, circular spots, growth of flesh and increase of flesh should be scarified.

The different veins, hydrocele and dropsy are to be punctured and tapped.

Fistula, wounds containing foreign matter and irregular wounds should be probed.

The three kinds of sand or gravel, tartar on the teeth, stone, foreign matter, dead foetus and faeces accumulated in the anus should be extracted.

Abscesses with the exception of the most difficult form, some kinds of skin-disease (*mahakuṣṭha*), local swellings, abscesses confined to the lobules of the ear, elephantiasis, blood poisoning, tumours, erysipelas, teeth-tumours and many other swellings and skin pustules should be drained.

Sutures should be applied in abscesses caused by deranged fat, after they are opened and well cleared, in wounds, and espe-

cially in wounds of movable joints. Sutures should not be applied in sores caused by caustics, fire and poisons, and in sinuses through which wind passes out or in which there is blood or a foreign body. Dust, hairs, nails, loose bones, etc., when found in a sore, should be removed before the application of sutures. The lips of the wound or sore should then be raised and placed in proper apposition and the sutures applied. The threads for suturing should consist of flax, or hemp, and other vegetable fibres or of sinew, or hair of the tail of beasts. There are four kinds of sutures: winding (*vellitaka*), like a sling (*gophorikā*), continued (*tunnasebani*) and interrupted (*riju-granthi*). There are three kinds of needles: round, three-sided, and curved like a bow. This last kind should be used for vital parts, abdomen and scrotum. (S.S. I. 25).

Surgical Instruments. Susruta describes two kinds of surgical instrument, blunt (*yantra*) and sharp (*sastra*). The *yantras* or blunt instruments number a hundred and one and are divided into six groups: (1) *svastika* (curved or hooked instruments); (2) *sandamsa* (forceps); (3) *tāla* (with ends like the mouth of a fish); (4) *nādi* (tubular instruments); (5) *salāka* (probes and sounds); (6) *upayantras* (accessory instruments).

(1) *Svastika yantras* should, as a rule, be made of iron, 18 fingers long, three ends shaped like the heads of beasts and birds of prey, the arms of the pair held together by a pin, the head of which is as big as a lentil and their ends for grasping the foreign bodies should be hooked or curved. There are 24 instruments in this class, 9 shaped at the end like the heads of the lion, tiger, wolf and other beasts of prey and 15 like those of the crow, heron, vulture, falcon, and other birds of prey. They serve to extract foreign bodies that are prominent and are easily handled.

(2) *Sandamsa yantras* or forceps are of 2 kinds, with or without arms, 16 fingers long, and are specially useful to extract *salva* or foreign bodies from the skin, flesh, veins, or sinews.

(3) *Tāla yantras* are 12 fingers in length. Their extremities are single or double and curved like the mouth of a fish. They are used in extracting foreign bodies from the nose, ears and other canals.

(4) *Nādi yantras* or tubular instruments of various sorts are used for various purposes. They have openings at one or both ends and are employed for extracting foreign bodies from the outer canals of the body, for the inspection of diseases in them, for sucking out fluids or helping in other ways in the treatment of diseases. Their diameters are adapted to the size of the canals or passages into which they are introduced, or to the pur-

poses for which they are employed. The varieties of tubular instruments are : those used in the treatment of fistula-in-ano, piles, tumours, abscess, hydrocele, ascites, stricture of the urethra, stricture of the rectum, those used for enemata, injections into the bladder and inhalations, and horns and gourds used for cupping.

(5) *Salāka yantras* or probes and sounds of different sorts are used for various purposes, their diameters and lengths varying accordingly. There are two varieties of them with their ends shaped like earth-worms, two shaped like the wing of an arrow, two like the hood of a serpent and two with hook-shaped ends. They are used for exploring abscesses and sinuses, for bringing together divided internal parts, displacing any material from one part to another within the flesh or bones and extracting any substances from them. Two varieties of probes have their ends shaped like the half of a pea and are slightly bent. These are used for extracting foreign bodies from the outer canals of the body. Six varieties have their heads covered with cotton and are used in wiping or cleaning abscesses, etc. Three varieties have their ends spoon-shaped, with beaked mouths and are used for applying caustic solutions. Three sorts of *salākas* have their ends shaped like the end of *jāmbava* fruit. Three have their ends hooked. These six varieties are used for applying the actual cautery. There is one variety used for extracting tumours from the interior of the nose. There is a variety for applying collyria to the eyes. One variety, used in clearing the urethra, has a diameter the size of the stalk of the *mālathī* flower.

(6) *Upayantras* or accessory instruments are : cord, braided hair, bandages, leather, bark of trees, twining plants, cloth, pebbles, stones, hammer, hands, feet, fingers, tongue, teeth, nails, mouth, hair, iron shoes, branches of trees, spittle, streams of water, objects exciting pleasure, loadstone, caustics, fire and medicines. These various instruments are used or applied to the body or parts of the body, to the joints, veins, etc., according to the requirements of each part. (S.S. 1. 7).

There are 20 sorts of cutting or sharp instruments. They are : (1) *maṇḍalāgra* or round-headed ; (2) *karapatra* or saw ; (3) *Vṛddhipatra* or razor of two varieties ; (4) *nakhasastra* or instrument for cutting nails ; (5) *mudrikā*, a cutting instrument of the size of the last phalanx of the index finger ; (6) *utpalapatra*, having the shape of the petal of the water lily ; (7) *arddhadhāra*, a knife or lancet with a single edge, the blade 2 inches long, the handle 6 inches ; (8) *sūchī*, needles ; (9) *kusapatra*, resembling a blade of kusa grass ; (10) *āṭimukha*, shaped like the beak of

the *sarāli* bird ; (11) *sarārimukha* or scissors ; (12) *antarmukha*, half moon shaped, with the cutting edge inside ; (13) *trikūrchaka*, a small trocar with three cutting surfaces ; (14) *kuṭhārika*, a small axe-shaped instrument ; (15) *vṛhimukha*, a small trocar with the head shaped like a grain of paddy ; (16) *ārā*, a long instrument with the sharp end the size of a sesamum seed ; (17) *vethasapatra*, a cutting instrument like the leaf of the rattan ; (18) *vadisa*, or hook ; (19) *dantasanka*, pincers for extracting teeth ; (20) *eṣaṇi*, or probes.

The *maṇḍalāgra* and *karapatra* are used for incisions and scarifications, the *vyddhhipatra*, *nakhasastra*, *mudrikā*, *utpalapatra* and *arddhadhāra* for cutting and puncturing parts, the *sūchi*, *kusapatra*, *āṭimukha*, *sarārimukha*, *antarmukha* and *trikūrchaka* for letting out discharges or opening abscesses, etc. The *kuṭhārika*, *vṛhimukha*, *ārā* and *vethasapatra* are used for puncturing parts or opening veins. The *vadisa* and *dantasanka* are used for extracting. The *eṣaṇi* is for exploring or serving as a guide. Needles are for sewing. The length of the *eṣaṇi* and *nakhasastra* should be 8 fingers. The shape of these instruments generally resembles that of the objects after which they are named.

These instruments should be made of good iron and have a fine edge and shape. They should be moderate in size and capable of being firmly grasped, and their ends should not be fearful to look at. Instruments used in surgical operations should be sharp enough to divide the hairs of the skin. Besides blunt (*yantra*) and sharp (*sastra*) instruments, Susruta mentions also accessory cutting instruments (*anusastras*). These may be made of bamboo-bark, glass or *kuruvinda*, a sort of ruby or stone which can be given a fine edge. Leeches, fire, caustics, nails, *goji*, *sephalika*, *sāka* (kinds of leaves), young shoots or roots, hairs and fingers are also used as accessory instruments. Bamboo-bark, crystal, glass and ruby should be used in incising and dividing parts in the case of infants, of persons too fearful of surgical instruments, or when these last are not available. Extraction and puncturing, if capable of being done by nails, should be performed with them. (S.S. 1. 8).

Caustics and cauteries. Caustics are superior to all cutting instruments and accessory cutting instruments, inasmuch as they perform the work of incision, puncture, and scarification, relieve derangements of the three *doṣas* and uniformly affect the diseased part to which they are applied. They promote suppuration, destroy parts, improve unhealthy sores and promote granulations, dry up discharges, stop bleeding, and abrade the skin. Alkalies do not agree with children, old and weak people or persons with a

tendency to haemorrhage from internal organs or a bilious temperament. They are made in three strengths, weak, medium and strong and are of two sorts, for external and for internal application. External application is advised in all kinds of skin diseases, haemorrhoids, fistula-in-ano and other fistulas, abscesses, mouth-diseases, throat-inflammation, etc.; internally they are used for poisons of lingering effect, swelling of the body, derangement of digestion, loss of appetite, calculi, internal abscesses, etc. They consist mainly of potash. (S.S. 1. 11).

Cautery (*agni*, *agnikarman*) is considered even more efficacious than caustics, inasmuch as after the use of the cautery the disease does not re-appear, and it can remove diseases which cannot be cured by medicine, instruments or caustics. It is particularly prescribed in tumours, fistula, swelling of testicles, elephantiasis, swollen glands, de-colorisation of the skin, bad wounds or ulcers, ophthalmia, headache, haemorrhoids and other diseases. Cauterisation is performed in four different ways, in circles, points, lines or over a continuous surface. There are four grades of cauterisation, scorching, vesication, complete cauterisation of the skin, and overburning. It can be effected not only with red-hot iron of various forms (*salāka*, *sūchi*, *jāmbavaustha*), but also with fluids like honey, syrup, oil or wax, brought to the boiling point, with hot cowdung and other hot objects. The physician should brand the patient until the required effect consisting of bustling noise, bad smell and shrivelling up of the skin is attained. (S.S. 1. 12).

Blood-letting was frequently practised. The means of withdrawal of blood were leeches, cupping, scarification or venesection. Indians were the first to use leeches for blood extraction. This was considered the mildest method. Leeches should be applied when the patient is old or imbecile or a woman or infant or a person of extremely timid disposition or of delicate constitution and therefore not fit to be operated upon. This mode of bleeding is the gentlest that can be devised. One should avoid the poisonous species of leeches. Detailed instructions are given for the preservation and application of leeches. (S.S. 1. 13).

Cupping of blood is similarly a mild form of treatment. A cow-horn with a small piece of cloth bound round the pointed end is used for this purpose, or a hollow calabash in which a burning wick is placed. Mention is also made of mere scarification (*lekhaṇa*, *prachana*) without the use of a sucking instrument. (S.S. 1. 13).

Both scarification and blood-letting (*sirāvyadha*) are effected with sharp instruments and are, therefore, more severe forms of

blood-letting. Bad blood causes abscesses, swelling of the spleen, fever, diseases of the mouth, eye, and head and many other diseases; therefore one should open the veins for letting out the superfluous blood. Blood-letting is not suitable for those who have undergone one of the five curing remedies or have taken oily substance, have no bad blood, are below 16 years of age or above 70, women who are carrying or lying in, or for people suffering from asthma, cough, diarrhoea, vomiting, anaemia, oedema all over the body, apoplexy, hemiplegia, etc. Lancets, *kuthārika* and *vṛhimukha* are mentioned as the instruments to be used in blood-letting. The maximum amount of blood that can be withdrawn is 1 *prastha* (16 *pala* or a handful). For stopping the bleeding Susruta recommends the application of cold first, as it makes the blood thick, and then an astringent decoction or ash for drying the wound, and in the worst cases a hot iron should be used. Besides, he mentions various powders for rubbing on in the case of excessive bleeding. (S.S. 1. 14).

Diagnosis and treatment of inflammation falls within the scope of major surgery. In the treatment of inflammation, pastes should be first employed, for they are applicable to all varieties and are the most efficacious. They are of three sorts, *pralepa*, *pradeha* and *ālepa*. When a paste is thin and cool it is called *pralepa*; an application put upon the skin like a poultice, whether warm or cold, small or large, is called *pradeha*; an application of intermediate thickness is called *ālepa*. *Ālepas* are useful in diseases caused by deranged bile and blood. *Pradehas* relieve inflammation caused by deranged air and phlegm, promote union of divided parts, purify ulcers, promote granulation and relieve pain in inflamed parts. They may be applied to the part, whether ulcerated or not. The form of *pradeha* which is applied to ulcers is called *kalka* or *niruddha ālepana*. It is used for restraining discharges from ulcers, for softening them and removing sloughs. It purifies ulcers and removes all defects in their interior. Detailed instructions for the use of the various kinds of paste are given by Susruta. (S.S. 1. 18).

Susruta describes 14 varieties of bandages (*bandha*): (1) *kosa* (egg-shaped) is applied to the joints of the thumb and fingers; (2) *dāma* (tail of a quadruped) is tied round a part for the relief of pain; (3) *svastika* (portico shaped) is applied to the joints, to the spaces between the tendons of the great and second toe, to the eyebrows and the breasts, to the soles, palms and the ears; (4) *anuvellita* (encircling) is applied to the limbs; (5) *pratoli* (broad) is a broad bandage for the neck and penis; (6) *mandala* (circular) is applied to round parts; (7) *sthaḡikā*

(giving firmness), a bandage filled with pastes, is applied to the end of the thumb, fingers and penis; (8) *yamaka* (double) is applied to ulcers; (9) *khaṭva* (four tailed bandage) is for the cheeks, temples and lower jaw; (10) *china* (banner) is a bandage for the inner angles of the eyes; (11) *vibhandha* (a firm bandage) is for the back, abdomen and chest; (12) *vitāna* (canopy) is a large bandage for the head; (13) *gophaṇa* (a sling for throwing stones) is a concave bandage for the chin, nose, lips, shoulders and pelvis; (14) *pañchāṅgi* (or bandage with five tails) is for the parts above the clavicles. Bandages are applied with three degrees of tightness according to the seat of the inflammation, tight, medium and loose. When a bandage is properly applied according to rules, it relieves pain, purifies the blood, and softens the part. When bones are comminuted, smashed, broken, dislocated or put out of place, and when nerves and veins are torn, they rapidly get well under the application of bandages and the patient sleeps, sits and moves about comfortably. The indications and contra-indications for the use of bandages are discussed fully by Susruta. (S.S. 1. 18).

The surgery of the ancient Indians reached remarkable heights. "Surgical treatment was founded upon a rich experience which showed itself in bold interference, accurate diagnosis, and, not least, in thoughtful after-treatment."⁴ Susruta deals with most of the surgical diseases, discussing their causes, symptoms, complications and treatment. The diseases dealt with are: hæmorrhoids, urinary calculi, fistula-in-ano, ascites, abscesses, hydrocele, hernia and scrotal tumours, fractures and dislocations, etc. Surgical treatment is not recommended in all cases. First the medical treatment and then the surgical treatment is discussed. Some of the chief achievements of Indian surgery may be mentioned.

Fractures and dislocations. Under the general term *bhagnam* are discussed dislocations and fractures. Dislocations are known as *sandhi-muktam* and fractures as *kāṇḍa-bhagnam*. Dislocations are divided into six types: *utplishtam*, *vislishtam*, *vivartitam*, *adhah-kshiptam*, *ati-kshiptam* and *tiryak-kshiptam*. Dislocations are characterised by inability of extension, flexion, circumduction and rotation of the dislocated limb, which becomes extremely painful and cannot bear the least touch. In case of a joint by two articular extremities (*utplishtam*) a swelling is found to appear on either side of the articulation, attended with a variety of pain at night. A little swelling accompanied by a constant pain and disordered function of the dislocated joint marks cases of simple

looseness (*vislishtam*) of the articulation, while pain and unevenness of the joint owing to the displacement of the connected bones distinguish a case of *vivartitam* (lateral displacement). An excruciating pain and looseness of the dislocated bone are the symptoms of a case in which a dislodged bone drops or hangs down from its joint (*adhah-kshiptam*). In a case of abnormal projection (*ati-kshiptam*) the dislocated bone is removed away from its joint which becomes extremely painful. A case of oblique dislocation (*tiryak-kshiptam*) is marked by the projection or displacement of the bone on one side accompanied by an intolerable pain. (S.S. 11. 15).

Fractures (*kāṇḍa bhagnam*) are divided into 12 kinds: (1) *karkaṭakam*; (2) *asvakarnam*; (3) *chūrṇitam*; (4) *pichchitam*; (5) *asthi-chchalitam*; (6) *kāṇḍabhagnam*; (7) *majjānugatam*; (8) *atipāthiṭam*; (9) *vakram*; (10) *chchinnam*; (11) *paṭitam*; (12) *sphuṭitam*.

The general symptoms of fractures are: A violent swelling (about the seat of fracture) with throbbings or pulsations, abnormality in the position (of the fractured limb), which cannot bear the least touch, crepitus under pressure, a looseness or dropping of the limb, the presence of a variety of pain and a sense of discomfort in all positions.

A case where a fractured bone, pressed or bent down at its two articular extremities, bulges out at the middle so as to resemble the shape of a knot (*granthi*), is called *karkaṭakam*. When the fractured bone projects upward like the ear of a horse it is called *asvakarnam*. The fractured bone is shattered into fragments in a case of *chūrṇitam* or it is a comminuted kind of fracture which can be detected both by palpation and crepitation. A smashed condition of the fractured bone marks a case of *pichchitam*, which is often marked by great swelling. A case where the covering or skin of the bone is cast or splintered away is called *asthi-chchalitam*. When the completely broken or severed bones project through the local skin it is called *kāṇḍabhagnam* (compound). When a fragment of the fractured or broken bone pierces into the bone and digs out the marrow it is called *majjānugatam* (impacted fracture). When the fractured bone droops or hangs down it is called *atipāthiṭam*. When the unloosened bone (from its position) is bent down in the form of an arch it is called *vakram*. When only one articular extremity of the bone is severed it is called *chchinnam*. When the bone is slightly fractured and pierced with a large number of holes it is called *paṭitam*, an excruciating pain being the leading indication. A case where the bone, largely cracked and swollen, becomes painful as if stuffed

with bristles of *suka* insect is called *sphuṭitam* (greenstick fracture). (S.S. 11. 15).

The treatment of fractures in particular limbs is described in detail. A bone shifted below is to be pressed upwards; one gone upwards is to be pressed downwards. By pulling, pressing, raising, pressing together the skin and bandage, all joints in the body should be set right and made firm and then they should be covered with proper strips of cloth smeared with ghee and on these broad but thin and tough inner bark of a tree and pieces of bamboo and other trees should be tied. A loose bandage gives the joint no firmness, a too tight bandage causes severe pain, heat, suppuration and tumour. The bandage is to be renewed every three days in summer, every seven days in winter, every five days in medium temperature; cold decoctions of *nyagrodha*, lukewarm oil and other medicines are also to be applied on the place, or they are to be anointed with these. A fractured bone in a youth is joined by treatment in the course of a month, in two months in the case of a middle-aged man and in three months in one of old age. Special rules are given for dislocations and fractures of the sole of the foot, thigh bone, hip bone, ribs, elbow-joint, knee, ankle-bone, hand-joint, arm, neck and throat, jaw-bone, nose, ears, skull, etc. (S.S. IV. 3).

Susruta mentions a fracture bed for the treatment of fractures of the lower extremity. In case of a fracture of the bone in the leg and thigh, the patient should be laid down on a plank or board and bound to five stakes or pegs in five different places for the purpose of preventing any movement of his limbs. The distribution of the pegs in each case should be as follows:— In the case of fractured leg bone, two on each side of the two thighs, making four, and one on the exterior side of the inguinal region of the affected side. In fracture of the knee joint, two on each side of the ankle joints, making four, and one on the side of the sole of the affected leg. The same sort of bed and fastenings should be used in cases of fractures and dislocations of the pelvic joint, the spinal column, the chest and the shoulders. (S.S. IV. 3. 39-40).

In case of faulty union of a (fractured) bone lying between two joints, the union should be again disjoined and the fractured bone again set right and treated as a case of ordinary fracture. (S.S. II. 15 and S.S. IV. 3).

The most outstanding performances of the Indian surgeons, however, were in the domain of laparotomy, lithotomy and plastic operations.

Writing about the treatment of perforation of the abdominal viscera, Susruta says that if the perforation is attended with excessive bleeding, the patient should be made to drink a portion of animal blood.⁵ In case of a perforation of the *koṣṭa* (abdomen), where the intestines have protruded or bulged out in an untorn condition, they should be gently re-introduced into the cavity and placed in their original position and not otherwise. According to others, however, large black ants should be applied even to the perforated intestines in such a case and their bodies should be separated from their heads after they had firmly bitten the perforated parts with their jaws. After that the intestines with the heads of the ants attached to them should be gently pushed back into the cavity and reinstated in their original situation therein. In a case where the re-introduction of the intestines into the abdominal cavity would be difficult owing to the narrowness of the mouth of the wound, it should be extended or widened with a small incision according to requirements, and the intestines re-introduced into their proper place. The orifice or mouth of the wound should be forthwith carefully sutured as soon as the intestines have been introduced into their right place. (S.S. IV. 2. 36-46).

Urinary calculi (*asmari*) seem to have been fairly common. The symptoms are clearly described. An excruciating pain is experienced either about the umbilicus or in the bladder or at the median raphe of the perineum or about the penis, during micturition, when the gravel is forming in the bladder. The urine is stopped at intervals in its outflow, or becomes charged with blood, or flows out twisted or scattered like spray, leaving a sediment of clear, sandy, red or yellow particles of stone. Moreover pain is experienced in the bladder at the time of running or jumping or in swimming or while riding on horseback or after a long journey. (S.S. II. 3. 6).

Susruta thus describes the operation of lithotomy:—The patient should be soothed (*snigdha*) by the application of oily substances, his system should be cleansed with purgatives and emetics and be slightly reduced thereby; he should then be fomented after being anointed with oily unguents and be made to partake of a meal. Prayers, offerings and prophylactic charms should be offered and the instruments and surgical accessories required for the operation kept at hand. The surgeon should use his best endeavours to encourage the patient and infuse hope and confidence in his mind. A person of strong physique and unagitated mind should first be made to sit on a level board or table as high as the knee joint. The patient should then be made to lie

on his back on the table placing the upper part of his body in the attendant's lap, with his waist resting on an elevated cloth cushion. Then the elbows and the knee-joints of the patient should be flexed and bound up with fastenings (*sātaka*) or with linen. After that the umbilical region (abdomen) should be well rubbed with oil or clarified butter and the left side of the umbilical region should be pressed down with a closed fist so that the stone comes within reach of the operator. The surgeon should then introduce into the rectum the second and the third fingers of his left hand, duly anointed and with the nails well pared. The fingers should be carried upwards towards the raphe of the perineum, i.e., in the middle line, so as to bring the stone between the rectum and the penis, when it should be so firmly and strongly pressed as to lock like an elevated *granthi* (tumour), taking care that the bladder remains contracted but at the same time even. An incision should then be made on the left side of the raphe of the perineum at the distance of a barleycorn and of a sufficient width to allow the free egress of the stone. Several authorities recommend the opening to be on the right side of the raphe of the perineum for the convenience of the operation. Special care should be taken in extracting the stone from its cavity so that it may not break into pieces, as, if it breaks, it is sure to grow larger again, however small the broken bit may be. Hence the stone should be extracted entire with the help of an *agravaktra yantra* (a kind of forceps, the points of which are not too sharp). In women the uterus lies close to the bladder; therefore, the stone should be removed by making an oblique and upward incision, otherwise a urine-exuding ulcer might result from the deep incision in that locality. The operation should be stopped and no attempt be made to extract the stone if the patient faints on the stone being handled. Susruta particularly warns that the operation is a dangerous one and has nothing to recommend it and should be undertaken only when all other measures fail, and then too with the permission of the king (S.S. IV. 7. 13).

Manu 8. 125 mentions the ears and nose among the parts of the body on which punishments are to be executed.⁶ Cutting of the nose was the usual punishment for adultery. This gave ample opportunities to Indian surgeons for operations of otoplasty and rhinoplasty. Susruta thus describes these :—Otoplasty. If the lobule of the ear is entirely wanting, a piece of skin should be dissected from the cheek, and a lobule made with the flap of living skin, thus turned back, but still connected with the cheek. Rhinoplasty. The method of repairing noses which have been cut. The portion of the nose to be covered should be first measured

with a leaf. A piece of skin of the required size should then be dissected from the cheek, and turned back to cover the nose. The part of the nose to which this skin is to be attached or joined, should be made raw, and the physician should join the two parts quickly but evenly and calmly, and keep the skin properly elevated by inserting two tubes in the position of the nostrils, so that the new nose may look comely. When the skin has been properly adjusted a powder composed of liquorice, red sandal-wood and extract of Indian barberry should be sprinkled on the part. It should then be covered with cotton, and white sesamum oil should be constantly applied to it. The patient should take some clarified butter. When the skin has united and granulated, if the nose is too short or too long, the middle of the flap should be divided and an endeavour made to enlarge or shorten it (S.S. I. 16).

Udara (dropsy with an abnormal condition of the abdomen) seems to have been a common disease. Eight different types are mentioned. Of these four are produced by the several or concerted action of the three deranged *doṣas*. Of the remaining types, two are known as *plīhodara* (including *yakritodara*), and *baddha-gudodara* (tympanitis due to constriction of the anus), the seventh *āgantuka* (traumatic of extraneous origin), and the eighth *dakodara* (ascites proper), *plīhodara* and *yakritodara* are dropsy associated with enlargement of the spleen or liver. *Parsisravi-udaram* results from perforation of the intestines. It gives rise to a copious flow of a watery exudation which constantly oozes out of the anus and to a distension of the lower part of the abdomen situated below the umbilicus. *Dakodaram* is the result of the derangement of the water-carrying channels of the body. This results in an enlargement of the abdomen, which becomes glossy on the surface and is full of water, being rounded about the umbilicus and raised like a water-drum. It fluctuates under pressure, oscillates, and makes a peculiar sound like a water-drum under percussion. All cases of *udaram* after the lapse of considerable time develop into those of ascites. Of these types *vaddha-guda* and *parsisravi* are incurable. The first four types of the disease are amenable to medical treatment. The other types require surgical treatment (S.S. 11. 7).

Susruta thus describes the operation of paracentesis of the abdomen :—The abdomen should be anointed with oil and fomented with hot water. Then attendants should hold the patient firmly by the arm-pits. The surgeon should make a puncture with a surgical instrument known as the *vrihimukha*, on the left side of the abdomen below the umbilicus, to the breadth of the thumb in depth and a distance of 4 fingers to the left of the dividing

line of hairs in the abdomen. Simultaneously with that, a metal tube or a bird's quill, open at both ends, should be introduced through the passage of the puncture to allow the morbid fluids (*doṣadaka*) accumulated in the abdomen to ooze out. The entire quantity of the morbid fluid should not be allowed to ooze out in a single day. It should be gradually tapped at intervals of three, four, five, to sixteen days. After the complete outflow of the fluid, the abdomen should be firmly tied with a bandage in order to prevent further accumulation of fluid. (S.S. IV. 14-22).

Another operation by the ancient Indian surgeons which has attracted attention is that for cataract. Susruta, in *Uttara-tantra*, gives a description of it, which, however, leaves much to be desired in the matter of clarity. Vāgbhaṭa II gives a simpler and clearer description which in its essentials conforms to Susruta's. Jolly gives the following translation of the passage : "In the middle (moderate) temperature the surgeon should himself sit in the morning in a bright place on a bench which is as high as his knee, opposite the patient who is sitting fastened on the ground at a lower level and who has bathed and eaten." After warming the eye of the patient with the breeze of his mouth, and rubbing it with the thumb and after perceiving impurity in the pupil (lens) he takes the lancet (*salāka*) with the fore-finger, middle finger and thumb fast in his hand while the patient looks at his own nose and his head is held firm. He inserts it in the natural opening (pupil) on the side, $\frac{1}{2}$ finger far from the black and $\frac{1}{2}$ finger from the external eye-corner and moves it upwards to and fro. He pierces the left eye with the right hand and/or the right eye with the left. If he has pierced rightly, then there comes a noise and a water drop flows out without pain. While encouraging the patient, he moistens the eye with woman's milk and then scratches the eye-apple with the edge of the lancet without causing pain. He then pushes the phlegm in the eye-apple gradually towards the nose where the patient must direct it by drawing up in the nose. Whether the diseased place (*doṣa*) is firm or moving, he foment the eye from outside. If the patient can now see the objects (shown to him) then the surgeon should pull out the lancet slowly, should place greased cotton on the wound and let the patient lie down with fastened eye." (S.S. VI. 17. 34-35 ; Jolly VII. 83).⁷

OPHTHALMOLOGY

"Dalhaṇa, the commentator of Susruta Samhita, mentions that Dhanwantari Divodasa, the King of Kasi, taught the subject of surgery to twelve of his pupils. To seven of them, of whom one was Susruta, he taught special surgery, *salya-tantra*; and he taught special surgery and the medical treatment of the part above the clavicle, including the ear, eye, mouth, nose, etc., i.e., *sālākya-tantra*, to five others: Bhoja, Nimi, Kanakayana, Gargaya and Galava. Just about this period, six other *sālākya-tantra* written by Videha, Satyaki, Shaunaka, Karala-bhatta, Chakahushyena, and Krishnātreya appeared to have been current and regarded with great esteem. To these twelve names, two more have to be added, Vāgbhaṭa and Mādhava."⁸

Dhṛdabala, discussing the diseases of the head, mentions that those of the eye are 96 in number according to the treatises on surgery. In these works full descriptions of them, as also their methods of treatment, have been laid down. On a topic which belongs to another province of medical science it is not proper to dwell at large in this treatise. (C.S. VI. 26. 129-130).

Ophthalmology was recognised as a branch of *sālākya-tantra* and was treated critically by these writers. Unfortunately, of the 14 writers on ophthalmology, only the treatises of Susruta, Vāgbhaṭa I and Mādhava are now available. Susruta II in his introduction to the *Uttara-tantra* specifically mentions that he consulted the *sālākya-tantra* as narrated by the King of Videha. The *sālākya-tantra* here referred to must be that traditionally credited to Nimi, the King of Videha and the reputed founder of ophthalmic medicine in northern India, who is quoted in the *Navanītaka* of the Bower Ms. Kanakayana is also mentioned in the *Navanītaka*. Vāgbhaṭa and Mādhava⁹ deal with the classification, diagnosis and treatment of eye diseases. We owe our fullest treatment of ophthalmology to the *Uttara-tantra* of Susruta II.

GROSS ANATOMY OF THE EYE AND ITS APPENDAGES :

The eye-ball is two fingers broad, a thumb's width deep and two and a half fingers in circumference. It is almost round in shape and resembles the teat of a cow. It is made up of five *mandalas* or circles, six *sandhi* or joints between the various *mandalas* and six *patala* or coverings.

The *mandalas* are: (1) *pakshma* (the circle of the eye-lashes); (2) *vartma* (the circle of the eye-lids); (3) *shveta* (the white circle or sclerotic); (4) *krishna* (the black circle or region of the cornea, which may imply the choroid, iris,

ciliary body etc.) ; (5) *driṣṭi* (the circle of the pupil, which may imply the anterior chamber, the lens and its appendages, the vitreous, the retina, and the optic nerve). The circles are so arranged that the one preceding lies within the next one in the list. To say that the first two cover the next four *mandalas* would be a better description.

The *krishna-mandala* (cornea) forms one-third part of the whole eye, while the *driṣṭi-mandala* (circle of the pupil) forms one-seventh part of the *krishna-mandala*.

In the pupillary area is to be found a natural hole which gives access to the interior of the eye (to the lens).

The *sandhi* (or lines of demarcation of the circles) are :— (1) *pakṣma-vartma* (between eye-lashes and eye-lids) ; (2) *vartma-shveta* (the fornices) ; (3) *shveta-krishna* (the limbus) ; (4) *krishna-driṣṭi* (the margin of the pupil) ; (5) *kaninika* (the inner canthus) ; (6) *apanga* (the outer canthus).

The *patala* : Two of the coverings are in the *vartma mandala*, the eye-lids region, i.e., the skin and the palpebral conjunctiva. Four are in the eye proper in which the dreaded disease *timira* (impairment of vision) occurs. Still continuing the description from the front, the foremost (or external) covering supports the 'light' and 'water' elements of the eye ; the second, behind it, is made up of the muscles (motor muscles outside the eye) ; the third is made of fat (the fatty layer around the eye-ball) ; and the fourth (the deepest or innermost) is made of bone (the receptacle in the skull for the eye-ball).

The different parts of the eye-ball are held together by blood-vessels, muscles, fat (vitreous) and a black substance (choroid). Beyond the choroid there is a mass of whitish substance, through which course the blood-vessels.

SUBTLE ANATOMY OF THE EYE : The eye is made up of all the five elements of which the universe is composed. The element earth contributes to the formation of its muscles, fire to that of the blood, wind (*vāyu*) to that of the black part of the eye, water to that of the white part (sclerotic, etc.), and ether (*ākāśa*) to the formation of lacrymal paths (glands, sac and duct) through which tears are discharged.

There are two *marmas* near the eye, *apanga* at the outer end of the eye-brow and *avarta*, above the middle of the eye-brow ; if these are cut, loss of eyesight results.

NUMBER OF EYE-DISEASES : Susruta gives a count of 76 eye-diseases, of which ten are due to *vāta-doṣa*, ten to *pitta-doṣa*, thirteen to *kapha-doṣa*, sixteen to vitiated blood (*rakta*) ; twenty-five are caused by the united action of the three *doṣas*

(*sannipāta*), and two are due to external causes (visible or invisible injury). Susruta adds *kukunaka* as the 77th. (S.S. VI. 1.).

Different editions of Charaka give 96 and 76 as the number of eye-diseases. Vāgbhaṭa I describes 94 and Mādhava 76. But none of them stick to this number, often adding one or two to the list.

LOCATION OF EYE-DISEASES : Susruta distributes the 76 diseases as follows :— Nine are confined to the *sandhi*; twenty-one to the eye-lids; eleven to the sclerotic; four to the cornea; seventeen to the entire eye-ball; twelve to *dṛṣṭi* (pupil, lens, etc.); two, though referring to *dṛṣṭi*, are due to external causes and are very painful and incurable (S.S. VI. 1. 22-23).

Mhaskar, after collecting all the available data from the literature and after a careful scrutiny of the same, comes to the conclusion that altogether the number of diseases described by these authorities is 82, 77 of which are those described by Susruta, the rest being new diseases added by Vāgbhaṭa. He describes their location as follows :— nine are confined to the *sandhi*; two to the eye-lashes; twenty-two to the eye-lids; seventeen to the entire eye-ball; eleven to the sclerotic; five to the cornea; and sixteen to *dṛṣṭi*.

Most of the common diseases of the eye were known to Susruta. It is not possible, however, to identify every one of the 76 he describes. Mhaskar has identified many of these diseases and has indicated the nearest western equivalents for the Āyurvedic terminology. His terminology is followed in the following description.¹⁰ Susruta divides the diseases into seven groups based on their location. Some of the important diseases are described below :

(1) Diseases of the eye-joints (*sandhigata roga*). Simple and suppurative dacrocystitis are noted. An acute and chronic variety of simple dacrocystitis is described under the names of *jala*, *pitta*, *raktha*, *kapha* and *pūya srāva*. Suppurative dacrocystitis is named *pūyālāsa*. Phlyctenular conjunctivitis (*parvani*) and blepharitis due to pediculi pubis and captis are referred to as *krimi-granthi*. (S.S. VI. 2).

(2) Diseases of the region of the eye-lashes (*pakshmagatha roga*). Under these trichiasis (*pakshma-kopa*) and elepharitis marginata (*pakshma-sāta*) are mentioned.

(3) Diseases of the eye-lid (*vartmagatha roga*). In this group chronic blepharospasm (*nimesha*), ptosis (*vātahata-vartma*), cysts, polypi, fatty tumours (*arbuda*) and various varieties of hordeolum or styes are mentioned. *Anjana*, *utsangini*, *kumbhika*,

visa-vartma; chalazion (*lagana*), blepharitis (*aklinna-vartma*), herpes ophthalmicus (*vartmashakara*), and telangiectases (*bhoni-tarsha*) and other affections not very easy to identify, are mentioned. Pothaki, a form of granular conjunctivitis, is described. The description is suggestive of trachoma. (S.S. VI. 3).

(4) Diseases of the whole eye-ball (*servagatha roga*). Under the name of *abhishyanda* four varieties of catarrhal conjunctivitis are described. These, if untreated, become mucopurulent and then orbital cellulitis is set up. Four stages of this cellulitis are described under the name of *adhimantha*. Panophthalmitis (*sashopha-netrapāka*) is also mentioned. Besides these inflammatory conditions, ophthalmoplegia (*shushka-akshipāka*) and neuralgias of the fifth nerve (*anyato-vata*, and *vata-paryaya*) are indicated by the descriptions. (S.S. VI. 6).

(5) Diseases of the sclerotic (*suklagatha roga*). Under this group various varieties of pterygium are described (*prastaryarma*, *snayvarma*, *lohitarma*, and *adhimansarma*), pannus (*sirājāla*), scleritis (*sirā-pīdika balasa*), xerophthalmia (*shuktika*), and subconjunctival ecchymosis (*arjuna*) are mentioned. (S.S. VI. 4).

(6) Diseases of the corneal region (*krishnagatha roga*). In this group acute keratitis (*sira-shukra*), corneal ulcer (*sa-vrana-shukra*), nebulae, maculae (*a-vrana-shukra*), hypopyon ulcer (*akahi-pakatyaya*) and anterior staphyloma (*ajaka*) are described. (S.S. VI. 5).

(7) Diseases of the vision region (*drishtigatha roga*). In this group two kinds of night blindness are mentioned (*nakulāndhaya* and *hrasva-jadhya*), and glaucoma or retinitis (*dhuma-driṣṭi* and *amala-dhyushita-driṣṭi*). Besides these, six varieties of *linganāsha* (blindness, optic atrophy or glaucomatous atrophy) are described. Complete *linganāsha* causes loss of vision and incomplete *linganāsha* admits of faint perception of brilliant objects like the sun, moon, stars, flashes of lightning, etc. The complaint has three preliminary progressive stages of defective vision called *timira* (darkness). *Timira* or partial vision ends in *linganāsha* if neglected. Three stages can be recognised :— First stage : objects appear dim and hazy when the deranged *doṣas* get incarcerated in the first *patala*. Second stage : false images of gnats, flies, hairs, nets, cob-webs, mirages, flags, circles, etc., appear ; objects seem hazy as if seen through a layer of water, and meteors of different colours seem to be falling constantly in all directions ; near objects may appear remote, and remote ones may appear still farther off ; a needle is difficult to thread ; there is also increasing pain. Third stage : some part of the field of vision is lost. An object may appear cut into

two, three or more parts; and the external world looks dim and confused. The pupil becomes coloured in different ways according to the *doṣas*. The sight becomes weaker. (S.S. VI. 7).

AETIOLOGY OF EYE DISEASES : This is entirely based on the *tri-doṣa* theory. The derangement or aggravation of the *doṣas* passes upward to the region of the eyes through the upcoursing veins and provokes there various dreadful diseases. This derangement may be caused by : diving into water immediately after exposure to the heat and glare of the sun ; looking at distant objects ; sleeping during the day and waking at night ; fixed and steady gaze ; excessive weeping ; over-indulgence in grief and anger ; worry ; injury ; sexual excess ; excess of alcoholic drinks ; fermented rice water and acid gruel ; repression of the calls of nature ; exposure of eyes to smoke and dust ; trickling of sweat into the eyes ; excessive vomiting ; repression of tears ; and constant contraction of the eyes to view small objects (S.S. VI. 1-14).

SYMPTOMATOLOGY (IN GENERAL) OF EYE DISEASES : Cloudiness of vision, slight inflammation, lachrymation, accumulation of secretion, heaviness and burning sensation, racking or aching pain, redness of eyes are indistinctly evident as premonitory symptoms.

In inflammation of the eye-lids, the eye feels as if studded with the bristles of the *shuka* worm ; there is much pain, impairment of vision in detecting colours or form and difficulty in opening and closing the eye-lids.

The symptoms of convalescence from eye diseases are : diminution of pain, itching and swelling, clearing of the eyes and stopping of lachrymation.

TREATMENT (IN GENERAL) OF EYE DISEASES : A physician should conclude from the above symptoms that the eyes are affected by a *doṣa* derangement ; suitable remedies should be administered ; otherwise the disease might become serious. The principle to be adopted is to prescribe a general treatment for the affection by the different *doṣas* in the body before those in the eye region are treated. The special remedial measures for *vāta*, *pitta* and *kapha* have been described under treatment.

SURGICAL TREATMENT OF EYE DISEASES : Of the 76 kinds of eye diseases, 11 should be treated with incision operations (*chhedya*), 9 with scarification (*lekhyā*), 5 with excision (*bedya*), 15 with venesection (*śirā-vyadhya*), 12 should not be operated upon and 9 admit only of palliative measures (*yāpya*), while 15 should be given up by an experienced surgeon

as incurable. The names of all these are listed and their individual treatments discussed. (S.S. VI. 8).

EYE DISEASES NOT TO BE OPERATED: *Sushka-akshipāka* (ophthalmoplegia), *kapha-vidagdha-drishti* (nyctalopia), *pitta-vidagdha-drishti* (hemeralopia), *amala-dhyushita-drishti* (glaucoma), *sukra roga* (keratitis and corneal ulcers), *arjuna* (subconjunctival ecchymosis), *pishtaka* (scleral nodules), *aklinnavartma* (blepharitis), *dhuma-drishti* (glaucoma), *shuktika* (xerophthalmia), *praklinna-vartma* (membranous conjunctivitis) and *valasa* (sclerosis) are diseases in which operation is not indicated. (S.S. VI. 8. 7).

CHAPTER IX

OBSTETRICS, GYNAECOLOGY AND PAEDIATRICS

The 'mythical' Āyurveda did not contain any section on either obstetrics or gynaecology, though there was one on paediatrics (*Kaumāra-bhṛtya*). This does not imply that this subject was deliberately omitted. Obstetrics did not generally form a branch of a physician's duty but was handled mainly by midwives. Perhaps owing to the social custom of the times, women did not readily seek the help of physicians or surgeons. Both Charaka and Susruta discuss the subjects of obstetrics and gynaecology at some length in their *samhitas*, particularly in *Sārira-sthāna* and *Chikitsa-sthāna*. Charaka concerns himself mainly with the medical aspects of gynaecology and with normal pregnancy and delivery. Susruta deals, in addition, with the surgical aspects of obstetrics. Paediatrics is not dealt with separately either by Charaka or the elder Susruta. They deal with this subject in their *sārira-sthānas*. They are concerned mainly with those diseases produced by derangements of the *doṣas* and no mention is made of the special diseases of children, the nine diseases attributed to the influence of the nine malignant *grahas*. These are dealt with in *Uttara-tantra* by Susruta the younger. Charaka and Susruta try their best to liberate medicine from the stranglehold of animism. This is clearly seen by the fact that neither of them recognises *Bhūta-vidya* as a branch of scientific medicine. They leave animism severely alone with regard to diseases which can be explained by the *tridoṣa* theory. It is only in the treatment of mental diseases, which are beyond the pale of rational medicine, that animistic explanations are invoked and magical therapeutics applied. But in Susruta animism is constantly in the background. It speaks for the rational outlook of Susruta that he reveals a very sober estimate of the art of surgery and its accomplishments, and he does not hesitate to acknowledge the limitations of the surgical art. In *Uttara-tantra*, *Bhūta-vidya* and *Kaumāra-bhṛtya* are both brought into scientific and rational medicine by the back door. The *Kaumāra-bhṛtya* of *Uttara-tantra* is so full of animism that it reminds one of Vedic medicine.

ANATOMY: The Pelvis. *Sroṇi*, pelvis or the pelvic cavity, is constituted of five bones, *sroṇi-phalaka* or *nitamba* (hip-blade) *bhaga* or *bhag-asthi* (pubes or pubic bone) ; *trika* (sacrum or sacral bone) ; and *guda* or *gud-asthi* (coccyx or anal or caudal bone). This agrees with the actual constitution of the pelvic cavity. For the pelvis includes the coccyx or caudal bone (*guda*) ; the triangular sacrum (*trika*), and the two *ossa innominata*. Each of these latter consists of three parts, the ilium, ischium and os pubis. The Indian anatomists divide the *ossa innominata* into two parts, a posterior and an anterior portion. The former consists of the ilium and ischium and is in duplicate, one on the right, the other on the left side of the skeleton, and is named *sroṇi-phalaka* (or *nitamba*), blade of the pelvis, or the hip-blade. The latter is formed by the prominent pubic arch and is called *bhag-asthi*, bone of the pubis.

The term *yonī* is used collectively or severally to mean the uterus, the vagina and the vulva. The vulva is below the bladder, and above it is the uterus.

The uterus is termed the *gharbāsaya*. It is adjacent to the urinary bladder and is located in the space bounded by the small intestines and *pakvāsaya* or large intestines. The foetus lies in this during the period of gestation. The shape of the uterus resembles the mouth of a *rohit-fish*, narrow at the opening and expanded at the upper end. The foetus lies in a crouched or doubled up posture in the uterus. (S.S. III. 42 & 48).

The vagina of a woman resembles the navel of a conch-shell in shape and is possessed of three involuted turns (*avartas*) like the interior of a mollusc. The entire length of the vagina and the uterus is 12 fingers ; the distance between the points below the anterior side of each of the thigh joints is 12 fingers ; the waist is 16 fingers. (S.S. III. 5. 47).

There are 20 extra muscles in women ; 10 muscles are about the two breasts, five in each, and attain their full growth during puberty ; four lie about the parturient passage ; of these two are about the external and two in the internal orifices of the vagina, three about the region of the os and three along the passages of the ovum and sperm. (S.S. III. 5. 42).

The ovaries were not known to the Indian anatomists, but they describe the Fallopian tubes. The two *ārtava*-carrying *srotas* (ducts) have their roots in the uterus, as well as in the channels (*dhamani*) which carry the menstrual blood ; if these are injured, it brings on sterility, suppression of menses, and incapacity for the sexual act. (S.S. III. 9. 11 and 12).

PUBERTY, MENSTRUATION AND THE MENOPAUSE. Menstruation commences at the 12th year, flowing once a month, and continues till the 50th year (or, according to some, till the 60th) when it disappears with the perceptive decay of the body. (S.S. III. 3. 9). It occurs every month and lasts five days. Though it commences in the 12th year, full maturity with regard to the *dhātus* of the body does not take place till the 16th year. 'Menstrual fluid' is produced from the juices of food, has the properties of blood and is the essential factor which makes impregnation possible. Though menstrual fluid originates from *rasa*, which has a cooling potency, it is heat-making in character. Healthy menstrual fluid is red like the blood of a hare or shellac water, leaves no stain on cloth and is easily washed off. (S.S. III. 2. 17-18). The fluid is free from mucus; there is no burning sensation and the quantity of the fluid passed is neither small nor large. The uterus and vagina (*yoni*) are folded up after the lapse of a menstrual period. The menstrual flow, accumulated during the course of the month, is led in time by the local *vāyu* through its specific duct (*dhamani*) into the mouth of the vagina. (S.S. III. 3. 7).

HYGIENE OF THE MENSTRUAL PERIOD : From the first day of the appearance of the menses the young wife should observe celibacy and should avoid sleep by day; she should not weep nor apply collyrium. She should not bathe or anoint the body with paste or oil; she should not pare her nails, nor should she run, laugh loudly, speak too much, hear a harsh sound, comb her hair, or sit in a strong draught or exert herself. She should sleep on a grass mat, eat rice and that too from a small saucer or a leaf, and take care not to meet her husband for three days. On the fourth day she should take a cleansing bath. (S.S. III. 2. 25).

DISORDERS OF FUNCTION : *Normal disturbances of menstruation.* (1) Diminution of the menstrual fluid makes the menses irregular and scanty; the vagina feels stuffed and painful; the diminution is due to excessive cleansing, cathartics or pacifying measures, repression of the natural urgings of the body, excessive exercise, amorous excesses, grief, use of unwholesome and inadequate food, etc. *Treatment.* Take alterative and cleansing measures and administer drugs of heat-making potency.

(2) Excess of 'menstrual fluid' causes excessive flow and aching of limbs; voluptuous sensations are stimulated and there is a reactionary weakness; the menses may smell foetid and haemorrhagic tumours (*rakta-gulma*) may appear; the increase is due to excessive use of substances that primarily contribute to their formation in the organism.

DISORDERS OF MENSTRUATION : *Primary Amenorrhoea.* Some women do not appear to menstruate at all ; at the time when the periods are due their faces become full and lively. Body, face, teeth and gums are covered with moist and clammy deposit. The woman feels sexual desire and speaks sweet words ; her eyes, hair and belly droop ; there is a distinct throbbing in the arms, thighs, mammae, umbilicus, perineum and buttocks, indicating that she has menstruated. (S.S. III. 3. 4 and 6).

Secondary Amenorrhoea or suppression or scanty menstruation is due to the obstruction of deranged *kapha* and *vāyu* in the passage (of the uterus and vagina) ; the menses are thin, scanty, and irregular ; the vagina feels stuffed up and painful. (S.S. III. 2. 22. 23).

MENORRHAGIA, METRORRHAGIA (*Asrigdhara, Rakta-pradara, Rakta-yoni*) : This is a disorder due to the blood (*rakta*) being contaminated by the deranged *doṣas*. The *rasa* is aggravated by grief, fright, anger, excessive physical labour, and exposure to sun and fire. This aggravated *rasa* in its turn aggravates *pitta*, which is imperfectly assimilated. This *pitta* invades the blood (*rakta*) which finds an outlet through the upper channels (mouth, nostrils), or through the lower channels (vagina, anus, urethra). There is an abnormal or excessive discharge of menstrual fluid ; it persists long after its usual time and appears at a premature or unnatural period ; there is aching of limbs ; the flow is painful ; and if excessive, there is vertigo, loss of consciousness, dimness of vision, difficulty of breathing, thirst, burning sensations, delirium, pallor, somnolence. Other *vātaja* troubles, like convulsions, may set in. (S.S. III. 2. 19-21).

DISCHARGES : *Pradara* (Metrorrhagia ; haemorrhages ; leucorrhoea). This is a disease which comprises the end results of deranged menstrual fluid. *Vāyu* enters the ducts which carry menstrual fluid and increases the flow ; *rakta*, *pitta* and *vāyu* predominate in this complaint and hence the disease is called *asrigdhara*, and because the menstrual blood is discharged copiously, it is also called *pradara*. Aggravation of *vāyu* is due to excessive indulgence in saline, sour, heavy, acid, pungent, or oily food ; excessive indulgence in flesh of domestic or aquatic animals that are very fat ; or indulgence in rice cooked with milk or in curds, buttermilk, and honey. There is excessive menstrual flow. There are pains in the body, twisting pains in the hands and legs, weakness, fainting fits, somnolence, thirst, burning of body, anaemia, drooping of the eye-lids, and other symptoms of aggravation of *vāyu*. Classification. *Pradara* is of four kinds, *vātaja*, *pittaja*, *kaphaja* and all three together, *sannipātaja*, according to the pre-

dominant *doṣas*. The menstrual fluid may be vitiated by *vāyu*, *pitta*, *kapha* severally or in combination; it then exhibits the characteristic colour and pain of the deranged *doṣa*. Such menstrual fluid is unfit for fecundation. It is incurable when affected by a combination of two or more *doṣas*. (C.S. VI. 30. 206-212).

DISEASES OF THE FEMALE ORGAN OF GENERATION (*yonivyapat*). Agnivesa put the following question to Atri:—"O holy one, women are the main root of pleasure and progeny of people; these are injured and obstructed by diseases which affect their organ of generation. I desire to hear for the benefit of human beings, what the causes are of these diseases, and what their symptoms are, along with the medicines prescribable for their cure." (C.S. VI. 30. 4. 5). In answer to this question, Atri describes the signs, symptoms and treatment of twenty diseases that affect the female organs of generation. There are 20 varieties of disease affecting the genital organs of women. They are as follows:—(1) that born of *vāyu*, (*vātajā*); (2) that born of *pitta* (*pittajā*); (3) that born of *kapha* (*sleshmajā*); (4) that born of all three together (*sarvajā*). The remaining 16 kinds, ascertained by considerations of contact with the vitiated elements as their cause, are: (1) *raktayoni*; (2) *arājaṣka*; (3) *acharanā*; (4) *aticharanā*; (5) *prākcharanā*; (6) *upaplūtā*; (7) *pariplūtā*; (8) *udāvirtini*; (9) *karnini*; (10) *putraghni*; (11) *antarmukhi*; (12) *suchimukhi*; (13) *suṣka*; (14) *vāmīni*; (15) *shandayoni*; and (16) *mahāyoni* (C.S. I. 19. 44).

Ḍṛdhabala (C.S. VI. 30. 7. 36) gives a list of twenty diseases of the female organs identical with that given by Charaka in *Sūtra-sthāna* (C.S. I. 19). In this list Ḍṛdhabala calls the disease *rakta-yoni* by the name *apraja*; the two terms are really synonymous. Susruta in *Uttara-tantra* (S.S. VI. 38) also gives a list of twenty diseases but his list differs from the one given by Charaka in many important respects. He omits five diseases, *antarmukhi*, *suṣka*, *upapluta*, *arājaṣka* and *apraja* (*rakta yonī*) and adds instead five new ones, *vandhyā*, *viplūtā*, *prasramsini*, *lohitāksharā* and *atyānandā*. Taking the two lists together we arrive at the number twenty-five, and not twenty, as the number of diseases of the female organs of generation.¹

The term, *yoni*, as already pointed out, is used collectively or severally to mean the uterus, the vagina, and the vulva.

There are two diseases which refer to the size of the vagina. *Suchimukhi* means a needle hole and refers to a vaginal opening which is extremely narrow due to an imperforate or cribbed hymen or when the vagina itself is narrow. Then we have the

mahāyoni, where the vagina is very dilated due to the indulgence in excessive sexual intercourse or to a ruptured perineum.

There are a number of diseases marked by vulvitis, vaginitis or leucorrhoea. In *pariplutā* and *viplutā* there is excessive local pain, fever, blue or yellowish discharge accompanied by shooting pains, and other signs of inflammation.

In the diseases *pittajā*, *sleshmajā*, *acharanā*, *aticharanā* and *sarvajā* the symptoms are suggestive of vaginitis. There is a burning sensation, suppuration in the organ and fever. The discharge is blue or white and has a decomposing smell.

In *udāvartā* there is a painful discharge, the menses are frothy and there is an aching and piercing pain. Here the uterus is overturned and the menstrual flow is directed upwards; there is great pain at the menstrual periods and the discharge of menstrual blood brings some immediate relief. The symptoms are suggestive of *dysmenorrhoea*, acute anti-flexion or retroversion. In *antarmukhi* there are severe pains in bones, muscles and vagina and the patient does not like coitus. The symptoms are suggestive of retroversion of the uterus. In *apraja-yoni* or *rakta-yoni* there is excessive vaginal discharge of blood, even though the woman be pregnant, suggesting chronic endometritis or cervical erosions. In *prasramsini* there is prolapse of the vagina or uterus and parturition is difficult and painful. In *putraghni* there are repeated abortions and an excessive discharge of menstrual fluid occurs during gestation. In *karnini* there are haemorrhagic growths or polypi and discharge of vitiated blood. This condition is suggestive of uterine tumour, inversion of the uterus, and vaginal polypi.

In *arājaṣka-yoni*, the blood is deranged on account of aggravation of *pitta* in the vagina and uterus. There is great emaciation and pallor. In *lohitāksharā* there is discharge of menstrual fluid with a burning sensation. There is burning sensation in the body, emaciation and pallor.

In *vāmīni* menstrual fluid and semen are ejected with a sound. Semen which has entered even the uterus is thrown out even after six or seven days, with or without pain in the generative organs.

In *vandhya-yoni* there is suppression of menstrual fluid, aching and piercing pains; short-lived children occur in women who do not conceive for six years after a child birth. An injury to the channels which carry menstrual fluid brings on sterility, suppression of the menses and incapacity for sexual intercourse. Many kinds of natural or absolute and acquired sterility are mentioned by later authors.

In *shandhi* there is no show of menses, no development of breasts, the vaginal canal is rough.

The causes of these diseases are : defective behaviour in matters of diet and way of life, a bad bed, corrupted menstrual blood, bad sperm, excessive sexual intercourse, etc. The derangements of the three *doṣas* are also responsible for the diseases. The above-mentioned *nidānas* bring about an upset of the *doṣas* and so produce symptoms characteristic of the deranged *doṣa* or *doṣas*. Susruta divides the above diseases into four groups from the point of view of *doṣa-vaiśāmya* (deranged *doṣas*). From derangement of *vāyu* come *vātala*, *udāhartini*, *bandhyā viphutā* and *pariplutā*; from derangement of *pitta* come *pittala*, *rudhira-kashra*, *vamini*, *putraghni* and *prasramsini*; from derangement of *kapha* come *atyānanda*, *karnini*, *acharanā*, *aticharanā*, and *sleshmalā*; from derangement of all the three *doṣas* come *shandi*, *phalini*, *mahayoni*, *sūchivaktrā* and *sarvajā*. (S.S. VI. 38. 5-8).

Patients suffering from the above diseases do not conceive; also they fall a prey to various diseases, such as swelling of the uterus, haemorrhoids and menorrhagia. The treatment varies according to the affected *doṣas*. After the application of nutrient and hot remedies the displaced vagina should be set right. An organ (uterus) that has fallen from its place should be restored (by manipulation) to its normal position, after softening it by oils and fomentations, while an organ that has become bent should be made straight, again by the hand. Again an organ whose mouth has become narrow should be widened (by the same means). Cases of prolapse should also be reduced (by manipulation). When again, the mouth has become wide, it should be narrowed (by pressure and bandages). An organ that has been displaced is felt by a woman to be like a thorn in her body (C.S. VI. 30. 43-44). In many cases insertion of cotton or pungent stuffs (for cleansing the yoni) or application of oil, etc., are recommended; baths, anointings, shower baths, substantial food consisting of milk, meat-broth and the like, various decoctions, etc., are further recommended. (C.S. VI. 30).

OBSTETRICS

CHARACTERISTICS OF HEALTHY SEMEN AND MENSTRUAL BLOOD (*ārtava*). Semen which is transparent like crystal, fluid, glossy, sweet, and emits the smell of honey; or, according to others, like oil or honey in appearance, should be considered healthy. The menstrual fluid (*ārtava*) which is red like the blood of the hare or the washings of shellac and leaves no stains on cloths (which may be washed off by simply soaking them in water) should be considered healthy. (S.S. III. 2. 17-18).

A co-ordination of the four factors : menstrual period (*ritu*), healthy womb (*kshetra*), nutrient liquid, i.e., *rasa* of digested food (*ambu*), healthy semen (*bīja*) and proper observance of the rules, is necessary for the conception and development of a healthy child. (S.S. III. 2. 33).

The first 12 nights after the cessation of the flow should be deemed the proper period for conception, though the menstrual fluid may or may not be actually visible, according to some authorities. (S.S. III. 3. 6). When congress occurs, during the menstrual period, of a man whose semen is not affected by any disease, with a woman whose generative organs, blood, and uterus, have no defects, and when in course of such congress between a male and a female, both of whom are possessed of such attributes, the semen and blood combined finds its way into the uterus and the *jīva* enters into it in consequence of the mind's attachment with acts, then conception takes place. (C.S. IV. 3. 2).

THE SYMPTOMS WHICH ARE MANIFEST UPON CONCEPTION. Disappearance of the menstrual flow ; constant salivation ; disgust for food ; nausea ; disrelish for food and drink ; longing for sour things in special ; regard for and gratification in things both high and low ; heaviness of all the limbs ; heaviness of the eyes ; appearance of milk in the breasts ; blackness of the lips and about the nipples ; dropsical swellings of the dorsa of the feet ; slight erection of the hairs of the body ; and flatness of the genital organ. (C.S. IV. 4. 24).

THE SIGNS WHICH POINT TO WHETHER THE FOETUS IS MALE OR FEMALE : During pregnancy the sex of the foetus is first differentiated in the 2nd month ; a lump-like appearance indicates a male, an elongated shape a female ; a tumour-like shape a hermaphrodite. Conception during the even days of catamenia causes a male child, while on odd days a female child results. Videha and Bhoja say that menstrual fluid flows less on even days, hence the son ; it flows more on odd days, hence the daughter. If the intercourse takes place on the 4th, 6th, 8th, 10th or 12th night that means a son is desired. He who wishes a daughter should have intercourse on odd nights beginning with the 5th ; but the 13th and the rest are always to be deprecated.

Birth of a male child is indicated if milk is detected in the right breast, if she raises the right foot first when walking, if the right eye looks larger, if she evinces a longing for things with a masculine name, if she dreams of receiving flowers of any masculine denomination or if her face becomes brighter ; the opposite conditions indicate a female child. If the sides become raised, and the forepart is found to bulge out, a sexless child results ; if the middle

part of the abdomen is sunk or divided in the middle like a leather bag, the result is twins. Desire for the company of females, bulging of the foetus on the right side of the abdomen, manly temper and actions indicate a male child; the reverse a female child; mixture of both indicates a hermaphrodite. (S.S. III. 3-20); (C.S. IV. 2. 23 and 24).

We have discussed foetal development in the chapter on anatomy. The regimen of life to be followed during the course of pregnancy is laid down in great detail for each month, as also the diet and medicine. Immediately after the ascertainment of pregnancy, the *enceinte* should avoid all kinds of physical labour, journey by carriage or in any conveyance, sitting on her haunches, sexual intercourse, fasting, other causes of emaciation of the body, sleeping by day, keeping late hours, indulgence, fright, and voluntary retention of natural urgings of the body. (S.S. III. 3. 12). She should avoid the use of dry, stale and dirty food, and also food prepared overnight; her food should be amply sweet, palatable, well-cooked, prepared with appetising drugs and abounding in fluid substances; she should never fast. The temperament also is to be regulated. She should always keep a happy joyful spirit, wear clean and white garments, engage in performance of peace-giving and benedictory rites and in devotion to the gods. She should avoid resort to cremation grounds, to a solitary retreat, or to a haunted tree; she should not sit under the shade of a tree or give way to anger, fright or other injurious emotions. She should avoid all acts harmful to the foetus. She should avoid the causes of abortion, such as a blow on the foetus, constant pressure on that part of the abdomen, travel in a bad conveyance on uneven roads, hearing of sudden loud sounds like that of gun-fire; she should not sleep on her back, for the umbilical cord twines round the neck of the foetus. If a healthy child is desired, it is best to observe health rules and proper regimen; if there is any disease, mild medicines should be taken; emetics, purgatives, errhines, and venesection are forbidden; unless there be a severe malady, no medicated enemas should be given and enemas should be given only after the 8th month (S.S. III. 8-10). Dietetic and therapeutic prophylaxis for each month of the pregnancy period is laid down in detail by Charaka. (C.S. IV. 8. 68-72). He also gives the preparations necessary for labour as regards the construction and equipment of the lying-in-room, the medicines required and attendants necessary. There should be in attendance many women who have borne several children, who are well-disposed and attached to the *enceinte*, are experts, skilled, of good common sense, kind, fond of children, cheerful, hardworking and trusted by

the *enceinte* ; there should also be many Brahmins to perform the necessary religious ceremonies (C.S. IV. 8. 28). With regard to midwives, four elderly ladies skilled in the art of *accouchement* and with whom the *enceinte* feels no delicacy, should attend ; they should pare their nails. (S.S. III. 10. 6).

CLINICAL COURSE OF LABOUR : *Signs of imminent labour.* There is a looseness of the sides of the abdomen and an untying of the umbilical cord of the child (from the cardiac cord of its mother) ; characteristic waist pain is felt. This pain is constant and severe both in the waist and in the back ; constant bowel-motions (diarrhoea, tenesmus), frequent micturition and mucous discharge from the vulva occur. Signs of labour are the typical pains and the discharge of (amniotic) fluid after the rupture of the membranes (S.S. III. 10. 4 and 5).

FIRST STAGE OF LABOUR OR THE PERIOD OF DILATION : The body of the *enceinte* should be anointed with oil and washed with warm water ; she should be made to drink large quantities of gruel made from rice, barley or wheat ; she should then be laid on a soft and spacious bed, head on a pillow and legs drawn up and slightly flexed. That the turning of the foetus has resulted, is known from the fact that it is loosened from the heart of the woman, comes into the belly and reaches the neck of the bladder, whereby the pains become more frequent. According to Charaka, she should then be placed on her bed and should try to press out the foetus, while one of the attendant midwives encourages her. Different views are held on the point whether, in case the delivery does not take place even after the pains, she should get up and pound corn in a mortar with a pestle evidently in order to intensify the pains by these severe movements. Charaka condemns such procedures, as they are injurious to the woman who is in a very delicate state of health. According to him, the face of the foetus is towards the mother's back ; the head is at the top and all limbs are close together ; when the delivery time comes, the *vāyu* of the delivery period reverses its position ; the head is now the lowest part and it escapes through the vaginal canal ; this is natural delivery and everything else is abnormal (C.S. IV. 6. 27 and 28).

SECOND STAGE OF LABOUR OR THE PERIOD OF EXPULSION : The mouth of the parturient canal should be lubricated in the natural and outward direction ; and she should be asked to bear down the child but not to make such an attempt in the absence of real pain ; she should gently bear down whenever there is pain in the pelvic, pudendal and pubic region and between the neck of the bladder and the pelvis. Great efforts should be made on the exit of the foetus out of the uterus and greatest efforts during its passage

through the canal, till delivery is complete. If the foetus remains stuck, the vagina should be fumigated with the skin of a black snake (S.S. III. 10. 8).

THIRD STAGE OF LABOUR OR THE PLACENTAL PERIOD : The midwife should examine the confined mother to ascertain if the placenta has come out or not. If it has not, one of the midwives should press her forcibly above the navel with the right hand, should seize her back with the left hand and should shake her thoroughly. Then she should press her on the hips with her heels, should clasp her buttocks and should press them together with all strength. If all these procedures do not succeed, in the last resort the midwife should pare her nails and, carefully putting her hand into the vagina, draw the placenta out (C.S. IV. 8. 86).

MANAGEMENT OF THE PUERPERIUM : This period is called *sūtikā* and extends to one and a half months after the delivery. Very strict regimen is laid down for this period. The body of the patient should be anointed with *bala* oil and smeared with a decoction of herbs subduing *vāta*. If any disease (*doṣa*) still remains in her, she should be given to drink on the same day, pepper (*pippali*), pepper-root and other pungent stuffs powdered and mixed with sweetened water. These medicines should be continued for two or three days until the spoilt blood is removed. For the next three days after the blood is purified, she should be given to drink oil or milk-pap prepared with *vidārighanda*. Then, according to the condition of her vitality and digestive power, she should be given rice with deer-sauce prepared with corn etc. When she has taken this diet for one and a half months, the restrictions in her diet and mode of living are to be stopped, and she is no more considered *sūtikā*. According to some, this period extends to the next appearance of the menses. The body of the woman is anointed and covered with a long piece of cloth in order that *vāta* may not enter and harm it. Anointing of the body, smearing, bathing etc., are in general recommended to the woman along with strength-giving food and drink. On the eleventh day the mother should take a ceremonial bath ; she should forego for a long time sexual intercourse, physical labour and indulgence in irritable emotions (S.S. III. 10-15).

The diseases of the confined woman are grouped under the name of *sūtikaroga*. During the growth of the foetus, the *dhātus* in the mother's body are lessened and are unstable ; the labour pains, straining efforts, excessive discharge of blood and other matters and the drying up of the *doṣas* reduce her body to a very enfeebled condition. Any disease acquired by the newly delivered mother through injudicious conduct of life soon changes into one

of a difficult type. Puerperal fever is specially mentioned, and is due to improper and excessive application of *sneha*, over-fatigue, physical waste, suppuration, introduction of any extraneous poison into the system, effect of miscarriage, injudicious regime on the part of the woman after delivery, first accumulation of milk after delivery and irregularities in the treatment of the puerperium. The symptoms are pains in the body, fever, tremors, thirst, heaviness of the body, oedema, pain in the abdomen and diarrhoea. An attack of fever due to miscarriage or to spontaneous accumulation of milk in the breast of the mother after delivery or any other cause should be treated with proper remedies for the *doṣa* deranged. Other diseases mentioned are delirium ; abnormality of the lochia ; and *prasuti-makkalla* ; mastitis, abscess and *rakta-vidradhi* (a blood tumour).

MAKKALLA : A woman who has miscarried, or has even safely delivered a child at term, may be afflicted with a dreadful abscess in the event of her taking injudicious and unwholesome food after parturition. This abscess is attended with hyper-pyrexia, and should be considered as having had its origin in the vitiated blood accumulated in the organism. The abscess which appears in the *kukshi* (in the iliac region) of a safely delivered woman, owing to the presence of the unexpelled blood clots in this region after child-birth, should be diagnosed as a case of *raktaja* abscess. The unexpelled blood is called *makkalla*. Such blood-clots, if not absorbed in the course of a week, are sure to suppurate (S.S. II. 9. 20-21).

Makkalla is of two kinds :

(1) *Garbha-makkalla* (extra-uterine pregnancy and blood mole). This occurs in pregnant women ; there is pain in the uterus ; then from any cause, the mind is excited, the *vāyu* is aggravated ; this causes pain in the flanks, proves very harmful to the foetus and then kills it.

(2) *Prasūti-makkalla* (pelvic abscess, retained lochia). Here the *vāyu* is aggravated of its own accord in the body of a newly delivered woman ; it stops the discharge of blood and other matter which normally takes place ; a tumour forms which lies either in the hypogastrium or the flanks or in the bladder region ; it causes pain in the abdomen and may ultimately lead to death of the patient.

Rakta-gulma. In females, there is a class of tumours connected with the vitiated condition of the menstrual fluid. The *vāyu* of a woman who is newly delivered, who has miscarried or who is in her menses, is deranged by taking wholesome food ; the flow of the menstrual fluid is suppressed and causes a tumour

(S.S. VI. 42. 10). This tumour is mobile and is easily mistaken for pregnancy; there is milk secretion from the breasts; lips and nipple-areola become dark; the symptoms of *rakta-gulma* and gravid uterus are similar, the difference being that in pregnancy, the movements of the foetus are frequent and the foetal parts can be palpated; the movements of a *gulma* are infrequent, the tumour is felt as a round mass and no foetal parts can be palpated. The foetus throbs and moves in every part of its body and its movement is not accompanied by pain; but a *gulma* throbs and moves as a whole and there is pain with it. (C.S. VI. 5. 17 & 18; M.N. 28, 15 & 16).

SYMPTOMS: There is local pain, cough, expectoration, dysentery, vomiting, water-brash, dyspepsia, discomfort, somnolence, lethargy, weakness, pallor, giddiness, retching, longing for abnormal food as in pregnancy, oedema of the feet, dilation of the vagina and foul vaginal discharge. **TREATMENT:** should commence after the lapse of the natural period of gestation and is the same as for *pittaja-gulma*. This condition is suggestive of ectopic gestation, blood mole, carnosus mole, fibroma, fibromyoma, myoma benign or malignant growth etc. (C.S. VI. 5. 169-178).

1. **ABNORMAL CONDITIONS OF THE GRAVID UTERUS:** Prolongation of the period of pregnancy without any cause. If, after a lapse of the full term of gestation, the child is not delivered, the *enceinte* should be made to thresh corn with a pestle and mortar and to sit or move on uneven ground. (S.S. 111. 10. 50).

2. **UPAVISHTAKA-GARBHA:** When a woman has menstrual flow or any other kind of discharge owing to food and drink of hot and keen properties, during the period of gestation, when the womb has become large and the substance of the foetus has become compact or solid, her foetus ceases to grow in consequence and remains in the womb longer than usual, give ghee cooked with '*jivaniya*' and '*anti-vāyu*' group drugs. (C.S. IV. 8. 54).

ABORTION AND MISCARRIAGE: Any menstrual flow in the second and third month of pregnancy should be considered an abortion (*garbhavichyuti*). The foetus is in a liquid state for the first four months and hence its destruction or issue from the womb is called an abortion; the limbs of the foetus gain in firmness in the fifth and sixth months of pregnancy and its issue at this time is called a miscarriage—*garbha-pāta* (S.S. 11. 8. 9).

CAUSES OF ABORTION: Excessive increase of the *doṣas*; over-indulgence in food and drink of keen and heating properties; suppression of the urgings of *vāyu*, urine and stools; indulgence in food made of hostile ingredients; use of uneven

beds and seats ; pressure on the womb, wrath, grief, envy, malice, fear, apprehension ; other acts which bring about the destruction of the foetus, such as excessive sexual intercourse, emetics, venesection, purgatives and enemas up to the eighth month of pregnancy. (C.S. IV. 8. 62).

SIGNS AND SYMPTOMS : A foetus on the point of being miscarried produces pain in the uterus, bladder, waist (*kati*), and the inguinal regions (*vamkshana*) and bleeding. A foetus being displaced from its normal position produces pain or spasms in the back and sides (*pārsva*), a burning sensation, excessive discharge of blood and retention of urine and faeces. A foetus changing place or shifting from one place to another inflates the abdomen (*koṣṭha*) (S.S. 111. 10. 45 & 46).

TREATMENT OF INCIPIENT ABORTION : The *enceinte* should avoid all contra-indicated things. If there is a menstrual flow on account of indigestion, the foetus usually dies. If, after the signs of pregnancy, menses occur from the fourth month onwards, there is acute pain in the bladder, lateral parts, hips, and entrance to the vagina, this signifies a possible abortion and steps should be taken to prevent it (*garbhasthapana*). Make the woman lie down on a soft and cool bed with the head a little sunk ; insert a piece of cloth soaked in liquorice and ghee into her vagina and urinal canal ; give a cool hip-bath ; apply to the lower part of the abdomen ghee washed a hundred or a thousand times ; apply to the same part a lint-piece soaked in cool cow's milk or in cool decoction of liquorice ; and also give the same milk or ghee to drink as medicine (C.S. IV. 5. 46-48).

TREATMENT OF THREATENED OR INEVITABLE ABORTION OR MISCARRIAGE : If, in spite of the foregoing treatments, abortions occur, then to purify the uterus and to lessen pain give powerful wines to drink ; give gruel without ghee with decoctions of the small group of five roots ; for one not accustomed to wines, give gruel of *uddālaka* rice with *sesamum indicum* seeds, decoction of drugs of the large group of five roots and paste of *piper longum* roots and fruit.

MISSED ABORTION : Two varieties of this condition are described : 1. *nāgodara* and 2. *līna-garbha*. 1. If a woman, during the period of gestation, observes fasts and vows and other religious acts involving penance, or if she indulges in bad food and drink, or if she abstains, through aversion, from oil and oily substances, or if she indulges in such articles of food and drink as are said to excite the *vāyu*, the foetus in her womb does not grow in consequence of being dried up through want of proper nourishment. The foetus in such circumstances remains in the womb

for more than the usual period and becomes motionless. Such a conception is called *nāgodara*. 2. *Līna-garbha*. The foetus becomes motionless. For *nāgodara* Charaka prescribes butter preparations and milk, eggs, and things which cause the growth of the foetus, also frequent horse and elephant rides. For *līna-garbha* he recommends gruels of the flesh of the falcon and fish. (C.S. IV. 8. 55-61).

SIGNS WHICH SIGNIFY THE DEATH OF THE FOETUS : If the foetus is developed but dead, the womb looks stretched, tight and cold as if there was a stone inside. The pain is violent, the foetus does not move, there appear no birth-contractions and there is no excretion from the vagina ; there is giddiness, thirst, difficult breathing and exhaustion, the eyes are sunk, the woman feels very uncomfortable, wavers around, gets convulsions, is partly unconscious and fatigued and cries out, is unable to sleep by day or night on account of difficult breathing ; she snorts, feels pain on drawing breath and becomes cachectic. (C.S. IV. 8. 63).

DIFFICULT LABOUR (*mūdhā-garbha*) : Causes of *mūdhā-garbha*. Sexual intercourse during pregnancy, riding on horse-back, etc., or in any sort of conveyance, a long walk, a false step, a fall, pressure on the womb, running, a blow, sitting or lying down on uneven ground, or in an uneven posture, fasting, voluntary repression of any natural urgings of the body, partaking of extremely bitter, pungent and astringent articles, eating inordinate quantities of *sakas* and alkaline substances, dysentery (*atisāra*), use of emetics and purgatives, using a swing or hammock, indigestion, use of medicines which induce the labour pain or bring about abortion, and such like causes tend to expel the foetus from its seat. These causes tend to sever the child from the uterine wall with its placental attachment owing to a kind of *abhighātam* (uterine contraction) just as a blow tends to sever a fruit from its pedicle.

The foetus thus severed and dislodged from its place not only excites peristalsis in the uterus, but induces a sort of constant, spasmodic contraction of the intestinal cavities (*koṣṭas*), producing pain in the liver, spleen, etc. ; the *apāna-vāyu* is obstructed by the spasmodic contraction of the abdomen, gets disordered and cannot help the expulsion of the foetus. Such an obstructed foetus is called *mūdhā-garbha*. (S.S. 11. 8. 2 & 3).

SYMPTOMS OF MUDHAGARBHA : The *apāna vāyu* thus obstructed produces any of the following symptoms : a sort of spasmodic pain in the sides or neck of the bladder or pelvic cavity or abdomen or in the veins or *ānāha* (tympanites with obstruction,

etc.) or retention of urine ; death of the foetus, if immature ; bleeding. If the foetus goes on to maturity, it takes up a transverse position at the entrance of the vaginal canal and is impacted there.

CLASSIFICATION : Cases of *mūdhagarbha* may be roughly divided into four different classes. (1) *Kīlah*. The foetus appears with its hands, legs, and head turned upwards and its back is firmly impacted at the entrance of the vagina. (2) *Prathikhura*. The hands, feet and head come out ; and its body is impacted at the entrance to the vagina. (3) *Bījakaha*. One hand and the head only come out ; and the rest of the body is impacted. (4) *Parigha*. The whole foetus lies in a horizontal position and obstructs the passage like a bolt.

Susruta mentions this classification but does not approve of it, as the deranged *apāna vāyu* can present the foetus in various different postures at the head of the vaginal canal. Susruta considers that the deranged *apāna vāyu* presents the foetus in 8 different ways :—(1) The foetus presents by the two thighs ; (2) a single leg flexed up ; (3) body bent double and thighs drawn up, so that only the breech is obliquely presented ; (4) chest, sides or back of the foetus is presented ; (5) foetus resting on the side, its arms round its head, and the hand coming out first ; (6) the head on one side and the two hands presented ; (7) two hands, legs, and the head of the child are presented ; the rest of the body is impacted in a doubled up posture ; (8) one leg presents, the other thigh being impacted. (S.S. II. 8. 4).

Mādhava gives another classification :—(1) Blocking the entrance with the head ; (2) with the belly ; (3) hump-backed through the turning of the body ; (4) with one arm ; (5) with both the arms ; (6) in circular position ; (7) the face downwards ; (8) tilted towards the sides.²

The obstruction of the child in the passage of parturition (*garbha-sangya*) may be affected in three different ways, owing to its head, shoulders or hips being presented in a wrong way and held fast in the passage. (S.S. IV. 15. 2).

TREATMENT OF MUDHAGARBHA : MEDICAL AND SURGICAL. Every care should be taken and no pains spared to bring a child alive into the world which is not already dead in the womb. Susruta recommends the recital of mantras which have the virtue of bringing out the foetus. Proper and useful medicinal remedies should also be employed for the delivery of the child. (S.S. IV. 15. 2).

If the living foetus does not come out, then with the permission of the king, apply gum of *bombax malabaricum* and ghee to the

hand and to the vagina, and remove the foetus with great effort. If a part of the foetus is not easily recognisable, either by turning and straightening, pressing, extending, folding, pushing up or away, lifting, or by any other means, cause it to come out in a line with the uterine and vaginal opening and then pull it out.

In case the foetus is dead, the *enceinte* should be made to lie on her back with her thighs flexed downwards, and her waist elevated a little by means of a pillow; the physician then should draw out the dead foetus. An abnormal presentation should be turned into a normal or cephalic one by version.

In the case of a leg presentation (*sakthi*), the foetus should be drawn downward by pulling its legs. In case a single leg is presented, the other leg of the foetus should be extended and then it should be drawn downward.

In the case of presentation of the buttocks (*sphik*), the buttocks should be first pressed and lifted up and then the foetus should be drawn downwards by the legs.

In the case of a horizontal presentation like a bolt and arrested in the passage, the lower extremities should be pushed upward with the hand and the child should be drawn out with its upper part (the head etc.) thus pointed downward, and brought straight into the passage of parturition.

In the case of the head being hung back a little on one side, the shoulder be lifted up by pressing it (with the hand) after chapening it, so as to bring the head to the mouth of the passage and the child should be drawn straight downward.

In the case of presentation of the two arms, the shoulder should be lifted up by pressing it (with the hand) and the head being brought back to the passage, the shoulders should be drawn downward.

The remaining two kinds of false presentations are irremediable. A foetus in these positions is called *viskambha* (bolt) and must be dismembered. The application of instruments (*sastra*) should be the last resort when such manipulatory measures fail.

In a case where there is necessity for using an instrument for purpose of delivery, the surgeons should cheer up the woman before the operation. The head or skull of the child in such cases should be severed with the knife known as the *mandalāgra* or the *anguli-sastra*; then, having carefully taken out the particles of the skull-bones (*kapāla*), the foetus should be drawn out by pulling it at the chest or shoulder with a *sanku* (forceps). Where the head would not be punctured and smashed, the foetus should be drawn out by pulling it at the cheeks or the eye-sockets.

The arms of the foetus should be severed from the body at the shoulders, when they are found to obstruct the passage, and then the foetus should be drawn out. The abdomen of the dead foetus should be pierced and the intestines should be drawn out if the abdomen is bloated, and then the foetus should be drawn out. When the thighs are impacted in the passage, the bones of the thighs should be first cut out and removed. That part of the body of the foetus should be severed and removed which prevents the foetus's withdrawal from the womb and the life of the mother should be saved at all hazards. (S.S. IV. 15. 2-11).

A child moving in the womb of a dead mother who has just expired during parturition at term, like a ghoat (*vastamara*), should be removed immediately by the surgeon from the womb, as delay in extracting the child may lead to its death. (S.S. II, 8, 10-11). Susruta does not mention how the removal is to be done. Vāgbhaṭa II instructs that it should be done by an incision over the bladder region. Presumably this is a reference to post-mortem Caesarian section. (A. H. II. 2. 53).

PAEDIATRICS (*KAUMARA-BHRTYA*)

The science of paediatrics was cultivated from very ancient times in India. Even in Vedic medicine we have references to children's diseases. Thus an incantation against worms in children is found in A.V. 5. 23. The *sārira sthāna* of Charaka and Susruta samhitas deals at great length with the care and management of new-born infants. The fourteenth chapter of Navanītaka of the Bower's Ms. (200 A.D.) deals exclusively with the treatment of children's diseases (*kaumara-bhṛtya*) and contains formulae for various kinds of diarrhoeas, vomiting, constipation, worms, jaundice, throat disease, skin disease, etc. These formulae are attributed to Jīvaka and Kāsyapa who were well-known physicians of children's diseases. Jīvaka³ bore the name of *kaumāra-bhṛtya*, which in Pali is *komara bachcha*, i.e., children's doctor.

Paediatrics (*kaumara-bhṛtya*) deals with (1) nursing and healthy up-bringing of infants and children; (2) purification and improvement of breast-milk found deficient in quality and quantity; and (3) treatment of diseases due to the use of vitiated breast-milk, of diseases peculiar to infant life and of diseases due to malignant stars.

Charaka and Susruta indicate that childhood continues up to 16 years of age.

THE CARE OF THE NEW-BORN CHILD: The shreds of membranes lying on the body of the child should be removed imme-

diately after its birth and its mouth should be cleansed with clarified butter. Then the child should be washed in either cold or warm water according to the season. Then its palate, lips, throat and tongue should be gently wiped with the forefinger covered with well-washed cotton. Having thus wiped the mouth, the child's head should be covered with a pad of cotton soaked in oil. After this the child should be made to vomit by means of a little ghee mixed with *saindhava* salt. Then the umbilical cord should be cut between two knots, with a sharp knife with the edge turned upwards, leaving a space of 8 fingers from the root of the navel. Then a string should be tied at any point round the uncut portion of the cord and it should then be loosely attached to the neck of the child. (If the umbilical cord is not properly treated, painful crookedness of body, gasping for breath and other diseases may be caused.) The child should be treated with ointments that are mild and appeasing of *vāta* and *pitta*, with smearings or sprinklings and with butter. (C.S. IV. 8. 92-95).

Since milk sets in the breast of a newly parturient woman, only three or four days after parturition, the child is given honey and butter mixed with *ananta* to drink, three times on the first day, butter prepared with *lakshmana* on the second and third day, then, on the fourth day, mother's milk with honey and butter, as much as can remain on the palm of the hand, twice a day. The clothes and bed of the child should be soft, light, clean and fragrant. The baby should be wrapped up in silk and laid on a bed covered with a silken sheet; it should be fanned with the branches of a *pīlu* and other trees. A thin pad, soaked in oil, should be constantly kept on its head and its body should be fumigated with the fumes of drugs (e.g. *vacha*, mustard, etc.) potent enough to keep off the evil influences of demons and evil spirits. The same drugs should be tied round the neck, hands, legs and head of the infant and the floor of the lying-in-room should be strewn with pounded sesamum, mustard and linseed (*athasi*). A fire should be kept burning in the chamber.

On the tenth day the rites of benediction should be performed and the child should be given a name. (S.S. III. 10. 13-20).

GENERAL CARE OF INFANTS : A child should always be kept in an inner apartment of the house; it should not be kept in an unclean and unholy place, under the sky, or on uneven ground, nor should it be exposed to heat, storm, rain, dust and smoke; it should be guarded from exposure to the sun and to the flash of lightning; it should not be placed under a tree or a creeper, on low-lying land, in a lonely house or in the shadow of one.

The child should be so handled as not to cause it discomfort. It should never be frightened or threatened, nor should it be awakened suddenly so as to startle it or lifted suddenly or flung aloft, as there is a risk of derangement of its bodily *vāyu*. An attempt to make the child sit up before it has learnt to sit steadily may make it a hunchback. It should be fondled lovingly and amused with toys and playthings. A child not upset in any of the above ways becomes healthy, cheerful and intelligent as it grows older. (S.S. III. 10. 38 & 39).

If the mother is unable to suckle the child a wet-nurse should be engaged. For the healthy growth of a child the wet-nurse should be born in the same country and be of the same caste ; she should be of good character, of respectable parentage, neither fickle nor garrulous, not greedy, possessed of many good qualities, not in the habit of doing anything that degrades a woman in life, of affectionate heart, free from vice, (gambling, day sleep, etc.), of noble disposition, not associating with low class people, skilled in sewing, pure in mind and body, averse to anything impure. She should be of sound health ; her skin should be healthy and unmarked by any mole or stains ; she should be fond of children ; she should possess healthy and living male children of her own ; she should have abundance of milk, with well-developed breasts, neither too pendulous nor too contracted. The breasts should be neither too high nor too long, neither too lean nor too plump ; the nipples should be of moderate size and easy to suck. If, for want of a suitable type of nurse, a child is nursed by any and every woman, it may fall an easy prey to disease. The child should be handed over to a wet-nurse on an auspicious day after washing it and wrapping it in a clean and untorn linen cloth ; then, after pressing out a small quantity of milk and washing the breast, the child should be made to suck the right breast. A child should not be given the breast of a hungry, aggrieved, fatigued, too thin, too corpulent, or pregnant woman, nor of a woman suffering from fever, nor of one who has acid dyspepsia, or is too fond of uncongenial and unhealthy diet, or whose vital principles are vitiated. The *doṣas* of a wet-nurse are aggravated by ingestion of indigestible or incompatible food or of those articles which derange the *doṣas* ; hence the milk may be vitiated. Means should be devised for the purification of the milk, as well as of the deranged *doṣas*. (S.S. III. 10. 22).

Milk is the sweet essence of the *rasa* manufactured from the digested food ; the *rasa* courses through the whole body and is ultimately concentrated in the breast of the mother ; it is the white fluid essence of herbs, cereals, etc. which enter into the food of

milk-giving beings ; it is therefore the best of all nutritive substances. It is heavy, sweet, slimy, cold, glossy, emollient, laxative and mild. It is kindred in nature to the essential principle of life ; so its use may be unreservedly recommended to all, and it is not forbidden in diseases due to deranged *vāyu* or *pitta*. The breast milk of a nurse or mother should be tested by casting it in water. Pure and healthy milk is thin, cold, clear, tinged like the hue of a conch shell, and mixes easily with water. Milk which instantly mixes with water, tastes sweet and retains the natural greyish tint, is pure and conduces to nourishment and health. The milk of a woman is wholesome, light, vitalising and appetising. (S.S. III. 10. 25).

Conditions which affect the composition of breast milk are the blocking of milk-ducts and the vitiation of the milk by the aggravated *doṣas*. Causes for the aggravation of the *doṣas* in the mother are : (1) Indigestion due to excessive indulgence in food, unassimilable or incompatible food, or taking of food at improper times ; (2) want of exercise, sleeping during the day and after meals ; (3) attempts to stimulate or suppress urgings of the body, e.g., urination, defecation, etc., and (4) loss of weight due to affliction of the mind and body, viz., anger, passion, anxiety and sleepless nights.

Characteristics of vitiated milk are : (1) Milk vitiated by *vāyu* in the mother has an astringent taste and floats on water ; (2) Milk vitiated by *pitta* is acrid and pungent and of a yellow colour (blue or pink in some cases) and floats on water ; and (3) Milk vitiated by *kapha* is thick and slimy and sinks in water. Any defect in the breast milk should be corrected with reference to the *doṣa* deranged and the season.

Excess of milk causes frequent secretion of milk, inflammation and pain in the breasts. This condition is due to excessive use of wine, flesh of animals living in marshy places, milk and plants with milky juice ; it may also result from excessive joy, contentment, peace of mind, absence of exertion and fattening food. It is to be treated by remedies that will not lessen the quantity of milk below the normal. Suppression or lessening of milk is due to anger, grief, absence of natural affection for the child, fasts and exertions. The breasts shrink in this condition. It is to be treated by drugs that increase *kapha*, by restoration of the mother's equanimity of mind and by attention to diet. (S.S. III. 10. 24).

Vitiated milk causes various diseases in children, and the location of these is recognised by their symptoms. If the child has pain in any part of the body, it touches the same part again and again, and cries if others touch it. In case of headache, it closes

the eyes and cannot hold the head straight. In case of heart-disease, it bites the tongue and lips, breathes with difficulty, closes the fists and looks upwards. If the bowels are defective, there is retention of urine, constipation, vomiting, flatulence and tremor in the body; the child becomes pale, it bites the mother's breast, its back becomes crippled and its abdomen distends. In diseases of the bladder, the urine is retained and there is pain and thirst, uneasiness, rolling of the eyes and fainting fits. If the whole body is affected, the child cries unnaturally. (S.S. III. 10. 28).

Cough, difficulty in breathing, fever and vomiting are caused if the suckling baby drinks excessively thick milk, from too full a breast from which no milk comes out. Such milk should be avoided. The vitiated milk of the mother or the nurse should be purified by various medicines. An emetic and purgative are particularly recommended; the patient must also take a specific diet (C.S. IV. 8. 49). Medicine is given to the mother and the child if the child is fed only with mother's milk or with mother's milk and rice. In fever the child should not be allowed the breast in order to pacify its thirst. Purgatives, enemata and emetics are also inadmissible except in danger of life. (S.S. III. 10. 29-32).

The natural food of infants is mother's milk, but if human milk cannot be obtained, that of a healthy she-goat or a healthy cow should be given in the quantity necessary to satisfy the child. (S.S. III. 10. 39).

When it is six months old any other light and nourishing liquid food may be given, in addition to milk. In the sixth month of its birth the child should be fed on light and wholesome boiled rice. (S.S. III. 10. 40).

Goat's milk has properties similar to those of cow's milk; it is curative in all diseases, owing to the agile habits of the goat, and to its habit of drinking little water and living on bitter and pungent herbs. (S.S. III. 10).

DISEASES OF THE NEW-BORN: If the cord is not properly cut, the following four diseases (all varieties of umbilical hernia) may occur: (1) *Uttundita*. A ball-like tumour of large proportions; (2) *Pindalika*. A flat circular tumour neither so elevated nor globular; (3) *Vinamika*. A circular tumour with elevated edges, and central portion depressed; (4) *Vijrumbhika*. A continuously increasing tumour. (S.S. IV. 5. 96).

LOHITAKA. The possibility of tetanus due to infected wounds is indicated in the complications of the operation of piercing the ear lobule of an infant six months old; there is numbness, stiffness of the muscles of the neck, tetanic symptoms, headache and earache.

DISEASES OF INFANTS AND CHILDREN. Infants and children are prone to diseases like adults but in a mild degree and suffer from the same derangements of *doṣas*, *dhātus* and *malas*. Signs, symptoms and treatment are likewise similar.

A further source of disease of childhood is teething. Thus, according to Vāgbhaṭa, diseases of every kind and of the entire body, particularly fever, headache, thirst, giddiness, dim-sightedness, inflammation of the eye, ulcer on the eyelids, vomiting, cough, difficult breathing, diarrhoea and erysipelas are caused thereby. The teeth appear in the eighth month or later if the child is healthy, otherwise at the end of the fourth month. If children suffer from pains caused by teething at too early an age, they cannot develop normally. But neither Charaka nor Susruta refers to teething as a cause of disease in children. Bower's Ms. has a formula for children's diseases caused by teething attributed to Kāsyapa. (B.M. Part II. Chap. 14).

DISEASES PECULIAR TO CHILDREN DUE TO THE INFLUENCE OF MALIGNANT STARS: Children's diseases are, however, particularly attributed to demoniac influences. Susruta considered nine diseases under this aetiology. Vāgbhaṭa I and subsequent writers add three more to his list. The diseases are attributed to the influences of the nine malignant stars or demons.

GENERAL CAUSES: These malignant stars (*graha*) or demons affect the person of a breast-fed child when the directions for the conduct of the mother or nurse are not followed and consequently proper benedictory rites are not performed, when the child is allowed to remain in an unclean state or when, becoming uneasy, it gets frightened and is rebuked or begins to cry. The demons make their appearance for the purpose of getting proper respect and worship. Being omnipotent and omnipresent, they cannot be seen by men when they enter the person of a child. (S.S. VI. XXVII. 4).

SIGNS AND SYMPTOMS: The child looks frightened and agitated, cries, becomes unconscious at times, wounds itself or its nurse with its teeth and finger-nails, gnashes its teeth, crooks the body, yawns, or moves its eye-brows with upturned eyes, vomits frothy matter, bites its lips, becomes cross, passes loose stools mixed with shreds of mucus, cries in an agonised voice, becomes dull in complexion, becomes weak, does not sleep at night, does not suck the breast as before, or emits a fishy, bug-like or mole-like smell from its body. (S.S. 111. 10. 41).

The nine *graha* diseases are:— 1. *skanda graha*; 2. *skanda-apasmāra graha*; 3. *śakuni graha*; 4. *revatī graha*; 5. *pūtana*

graha ; 6. *andhapūtanā graha* ; 7. *śītapūtanā graha* ; 8. *mukhamandikā graha* ; 9. *naigameṣa graha*.

DISEASES DUE TO EACH OF THE NINE GRAHAS :—1. *Skanda graha* (convulsions ; cerebrospinal meningitis ; encephalitis). There is swelling of eyes ; they roll much ; one eyelid is fixed or motionless ; both eyes are red ; the child looks frightened ; features are distorted ; it moans a little, clenches its fists ; it has aversion to breast milk ; stools are hard and constipated ; the body emits a bloody smell ; there is frequent tossing of the head ; bending of neck, grinding of teeth, twisting of face ; one side of the body is paralysed ; there is perspiration, salivation. The child becomes blind, lame or generally dies.

2. *Skanda-Apasmāra Graha* : (basal meningitis ; encephalitis ; tetany etc.). Alternate fits of fainting and consciousness ; convulsive jerks of legs and hands as in dancing ; foaming at the mouth, yawning, passing of flatus, stool and urine ; hair pulling, bending of neck, eyes looking upwards, twitching of eye-brows, biting of breast teat on own tongue while sucking, losing temper, fever, sleeplessness, smell of body like pus or blood, death or permanent disfigurement of any limb.

3. *Sakuni Graha* : (chicken pox, erysipelas). There are eruptions of vesicles attended with burning sensation, which later suppurate and burst ; a large number of secreting ulcers appear ; there is a peculiar bird-like smell of the body ; looseness of limbs, starting up in terror. Stomatitis, diarrhoea, ulcers on tongue, palate, and throat ; boils and burning in joints and boils round the anus.

4. *Revatī Graha* : (green diarrhoea, dysentery, acute indigestion etc.). There are green stools, and urine, stomatitis, bruised pain all over the body ; the face has a blood red colour ; the complexion is deep yellow or dark brown ; there is fever and rubbing of the nose and ears. Hiccough, turning of the eyes aimlessly, twitching and redness of mouth, loss of weight, goaty smell of the body.

5. *Pūtanā Graha* : (diarrhoea, cholera infantum, acute indigestion etc.). There are loose stools, thirst, vomiting, tired feeling, disturbed sleep and goose-flesh skin, tremors, drooping of eyelids, hiccough, flatulence, absence of urine, crow-like smell of the body.

6. *Andhapūtanā Graha* : (Measles, scarlet fever, etc.) There is fever, cough, vomiting, hiccough, diarrhoea, dislike for breast milk, oedema, discoloration of skin, and tendency to lie face downwards ; foetid stools, drooping of eyes, severe pain, itching,

ophthalmia, restlessness, hard voice, tremors, sour or fishy smell of the body.

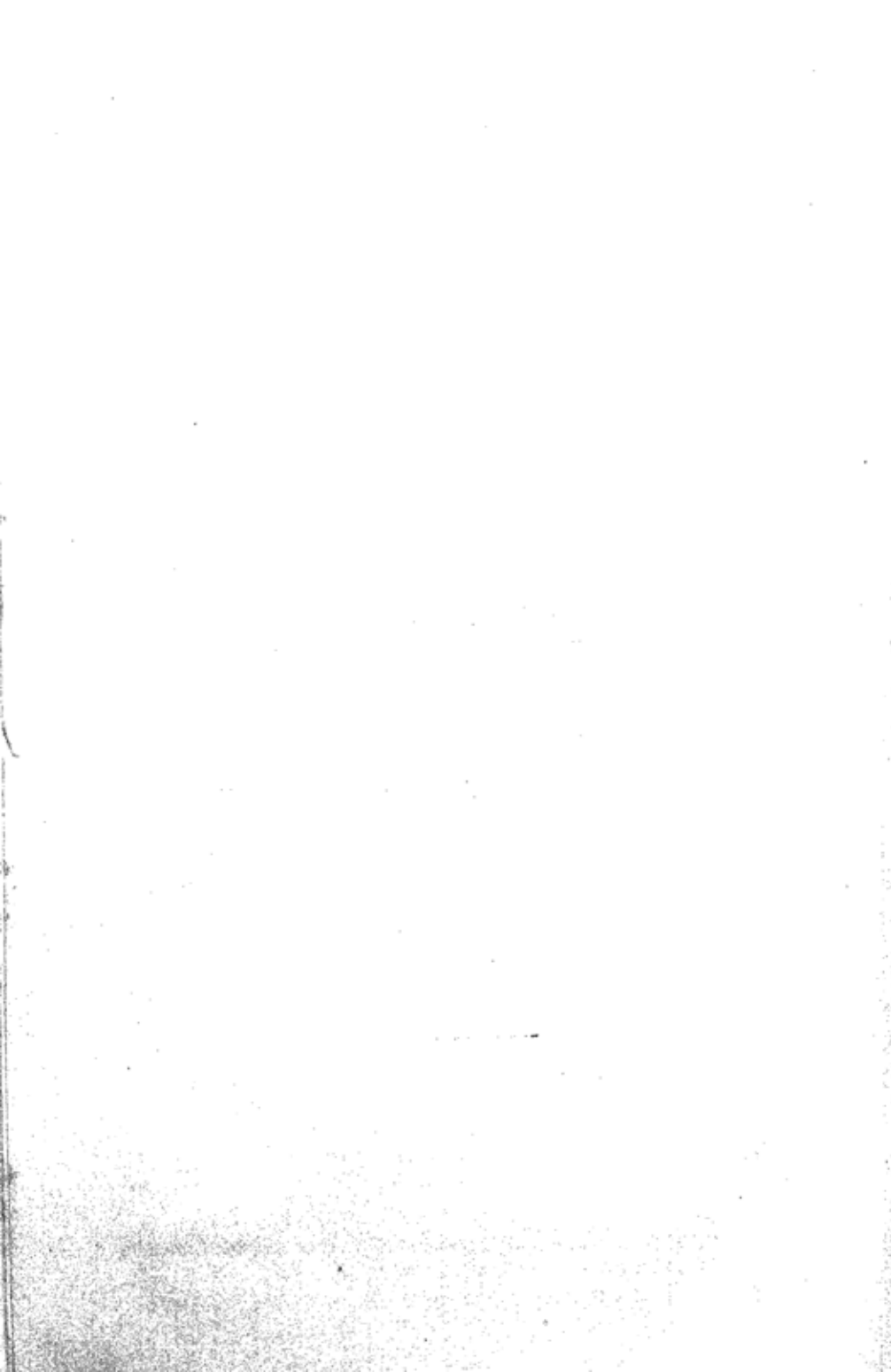
7. *Śitapūtanā Graha* : (cholera infantum). There is constant diarrhoea, flatulence and gurgling ; severe shivering and constant startling ; comatose sleep ; constant crying and blood smell of limbs and body.

8. *Mukhamandikā Graha* : (cirrhosis of liver). Complexion is pale, oedema of the face and extremities, net-like veins of the body, voracious appetite and urine like smell of the body ; fever and dyspepsia.

9. *Naigameṣa Graha* : (peritonitis). There is frothy vomiting, anxious appearance, upward gaze of the eye, orthotonus, constant fever, fits of unconsciousness and fatty smell of the body.

Divested of their animistic aetiology, these diseases form a very interesting group. They include all the important diseases of childhood, meningitis, encephalitis, the eruptive fevers like small-pox, chicken pox, measles, diarrhoea and bowel affections of all varieties, nephritis, pyelitis and infantile cirrhosis. This last is particularly interesting as it points to the prevalence of cirrhosis among children even in those days.

TREATMENT : (1) Keep the child in a clean room ; (2) rub the body with old matured ghee ; (3) strew mustard on the floor ; (4) burn a mustard oil lamp. Vāgbhaṭa further advises baths, massage, fumigation and internal medication. (S.S. VI. 27-38).



APPENDIX

NOTES AND REFERENCES

PREFACE

- ¹ Rawlinson, H. G. "India in European Literature and Thought", p. 36, in "The Legacy of India". The Clarendon Press. 1951.
- ² Allbutt, C. "History of Medicine", p. 1, in "A System of Medicine" by Allbutt and Rolleston, Macmillan and Co. Ltd., London. 1909.
- ³ Dawson, W. R. "Medicine", p. 179, in "The Legacy of Egypt." The Clarendon Press. 1953.
- ⁴ Neuburger, M. "History of Medicine", English Translation by E. Playfair, Vol. 1, p. 43. Oxford University Press, London. 1910.

GENERAL INTRODUCTION

- ¹ This is the derivation of "Āyurveda" given by Susruta. Charaka gives the derivation of "Āyurveda" as that which instructs us about life. C.S. 1. 30. 20.
- ² Some recent writers maintain that there were three schools of medicine : (i) The School of Physicians headed by Ātreya ; (ii) The School of Surgeons headed by Dhanvantari ; (iii) The School of Rasasiddhas headed by Kāsyapa. Medical tradition knows two men of that name, an older and a younger. The older Kāsyapa is mentioned in Charaka and Navanītaka. He was a contemporary of Buddha and is reputed to have been a children's doctor. A fragment of Kāsyapa Samhita, chiefly relating to fever and its treatment, was discovered by Hariprasad Sastri in the Nepal Durbar Library (Report, Calcutta, 1901). This Samhita professes to be based on an earlier Agnivesa Tantra. There is no reference to a third school of medicine in the ancient medical classics.

- ³ Foote, R. B. "Catalogue of Prehistoric Antiquities in the Madras Museum", Madras, 1901.
- ⁴ Refer Chapter VII on "Race Movements and Prehistoric Culture" by S. K. Chatterji, in "The Vedic Age", Allen and Unwin Ltd., London, for a fuller treatment of the subject.
- ⁵ Refer Chapter XVIII on "Religious Traits of the Wild Tribes", "Religions of India," by E. W. Hopkins, Ginn and Co., Boston, 1895, for a detailed discussion of the subject.
- ⁶ Wheeler, M. "The Indus Civilization," p. 82. Cambridge University Press, 1953.
- ⁷ Wheeler, M. "The Indus Civilization," p. 4.
- ⁸ Piggott, S. "Prehistoric India," pp. 145 & 147. Penguin Books, 1950.
- ⁹ Piggott, S. "Prehistoric India," pp. 257 & 261.
- ¹⁰ Refer Chapter VIII, "The Vedic Age", for further details on this subject.
- ¹¹ Piggott, S. "Prehistoric India", pp. 201 & 203.
- ¹² Piggott, S. "Prehistoric India", p. 206.
- ¹³ Macdonnel, W. "A History of Sanskrit Literature," p. 31. Heinemann, Ltd., London, 1925.
- ¹⁴ Davids, Rhys. "Buddhist India," p. 144. Susil Gupta (India) Ltd., 1950.
- ¹⁵ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 281. Cambridge University Press, 1932.
- ¹⁶ Piggott, S. "Prehistoric India", p. 168.
- ¹⁷ "The Indus Civilization", p. 84. The writer is indebted to this book, "Prehistoric India" and Chapter IX of "The Vedic Age", for the information given on the Indus Valley Civilization.
- ¹⁸ Radhakrishnan, S. "Indian Philosophy", Vol. I, p. 119. Allen and Unwin, Ltd., London, 1923.
- ¹⁹ Zimmer, H. R. "Hindu Medicine", p. 2. The Johns Hopkins Press, Baltimore, 1948.
- ²⁰ Bolling, G. R. "Diseases and Medicine : Vedic" in The Encyclopaedia of Religion and Ethics, 1914.
- ²¹ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 289.
- ²² Bolling, G. R. "Diseases and Medicine : Vedic".
- ²³ Sigerist, H. "A History of Medicine", Vol. I, p. 262. Oxford University Press, 1951.
- ²⁴ There are four Vedas : viz. Rig, Yajur, Sama and Atharva. Each consists of three parts : viz. Samhitas, Brahmanas and Upanishads. Later mnemonic abridgements of religious and

ceremonial rules called the Sūtras were added to each Veda. The Brahmanas include the precepts and religious duties. The Upanishads are the concluding portions of the Brahmanas which discuss philosophic problems. The full name of the Atharva-veda is Atharva-veda Samhita. The Brahmana connected with the Atharva-veda is the Gopatha-Brahmana. The Kausika-sūtra is the earliest and most important Sūtra connected with the Gopatha-Brahmana. The reference here is to Gopatha-Brahmana, I. 10.

- 25 Chāndogya Upanishad, VII, 1. 2. "Hindu Scriptures", edited by N. Macnicol. J. M. Dent and Sons, Ltd., London, 1938.
- 26 Susruta Samhita, I. 1.
- 27 Davids Rhys. "Buddhist India", p. 155.
- 28 Dasgupta, S. "A History of Indian Philosophy", Vol. I. Introductory, pp. 8 & 9.
- 29 Both Charaka and Susruta mention the eight divisions of the mythical Āyurveda. It is interesting to note that Charaka mentions Kāyachikitsa as the first division, whereas Susruta mentions Salya as the first division.
- 30 It was traditionally believed that there existed an "Aṣṭāṅga-Āyurveda". Although this is not mentioned in Vedic literature, it is referred to in both medical and non-medical literature. Charaka and Susruta mention it. Charaka and Bhela Samhitas consist of eight sthānas or divisions, in accordance with this tradition. The names of Aṣṭāṅga Samgraha of Vāgbhaṭa I and Aṣṭāṅga-Hṛdya Samhita of Vāgbhaṭa II show that their authors acknowledge this tradition. The Mahābharata has a reference to Aṣṭāṅga Āyurveda.
- 31 Hoernle, A. F. R. "Medicine of Ancient India", Part I, Osteology, p. 7. The Clarendon Press, Oxford, 1907.
- 32 Charaka Samhita, Vimāna Sthāna, Chapter VIII. Charaka here discusses the essentials of a scientific treatise on medicine.
- 33 Zimmer, H. R. "Hindu Medicine", pp. 52-53.
- 34 Zimmer, H. R. "Hindu Medicine", pp. 56-57.
- 35 The writer is indebted to Dasgupta's "History of Indian Philosophy", Vol. I, Chap. viii and Vol. II, Chap. xiii for the materials of this section. All the quotations are from these two chapters.
- 36 Hoernle, A. F. R. "Medicine of Ancient India", Osteology, p. 113.
- 37 Zimmer, H. R. "Hindu Medicine", p. 49.

- ³⁸ Hoernle, A. F. R. "Studies in Ancient Medicine", V, p. 856. Journal of the Royal Asiatic Society, 1909.
- ³⁹ Zimmer, H. R. "Hindu Medicine", p. 58.
- ⁴⁰ The Bower Manuscript, Facsimile leaves, Nagari transcript, Romanised transliteration and English translation with notes, edited by A. F. R. Hoernle, "Archaeological Survey of India". New Imperial Series, Vol. 22, Calcutta, 1893-1912. This section is based on this edition.
- ⁴¹ Hoernle, A. F. R. "Studies in Ancient Medicine", V. Journal of the Royal Asiatic Society, 1909.
- ⁴² Hoernle, A. F. R. "Medicine of Ancient India", Osteology, p. 10.
- ⁴³ "Vinaya Texts", translated from Pali by T. V. Rhys Davids and H. Oldenberg. "The Mahavagga", V-X, The Sacred Books of the East, Vol. 17. Clarendon Press, Oxford, 1882.
- ⁴⁴ Hoernle, A. F. R. Journal of the Royal Asiatic Society, 1906, pp. 288-289.
- ⁴⁵ Allbutt, C. "History of Medicine" in "A System of Medicine" by Allbutt and Rolleston, 1928, Vol. I, p. 1.
- ⁴⁶ Singer, C. "History of Medicine", p. 1. Clarendon Press, Oxford, 1928.
- ⁴⁷ Inge, W. R. "Religion" in "Legacy of Greece", p. 28. The Clarendon Press, Oxford, 1921.
- ⁴⁸ Jolly, Julius. "Indian Medicine", p. 27. English translation by C. G. Kashikar, Poona, 1951.
- ⁴⁹ Levi Sylvain. "Notes on the Indo-Scythians". "Indian Antiquary", Vol. II, p. 386, 1903.
- ⁵⁰ Smith, V. A. "The Oxford History of India", pp. 138-140. The Clarendon Press, Oxford, 1923.
- ⁵¹ Jones, Sir William, "Discourses".
- ⁵² Weber, A. "History of Indian Literature", English translation, 1914.
- ⁵³ Brock, A. J. "Greek Medicine", pp. 9-10. J. M. Dent and Sons, Ltd., London, 1929.
- ⁵⁴ "The Mahavagga", V-X, English translation by Rhys Davids and Oldenberg, Kandhaka, VI.
- ⁵⁵ Sarangadhara was the first writer to deal with Nādi-pariksha. In his Samhita, Pūrva Khanda, Chapter III, he has a section on Nādi-pariksha. He is also the oldest author dealing with the process of calcination and similar processes. He also mentions opium. Sarangadhara Samhita must have been written, at the latest, about the 13th century A.D. (Jolly).
- ⁵⁶ Brock, A. J. "Greek Medicine", p. 5.
- ⁵⁷ Hopkins, E. W. "Religions of India", p. 559.

- ⁵⁸ A comparison between "Airs, Water and Places" of Hippocrates and the treatment of the same subject by Charaka in *Vimana Sthāna*, Chapter III, where Charaka deals with the subject of Place, Time, Atmosphere and Water and their effects on health, is very revealing. Refer the writer's article on "Airs, Waters and Places of Charaka Samhita", *Indian Journal of the History of Medicine*, Vol. V, No. 1, pp. 9-18, 1960.
- ⁵⁹ Zimmer, H. R. "Hindu Medicine", p. 75.
- ⁶⁰ "Mahavagga", *Kandhaka VIII*. English translation by Rhys Davids and Oldenberg.
- ⁶¹ Neuburger, M. in "Medicine of the Indians" in his "History of Medicine", Vol. I, mentions that the medical instruction lasted for six years (p. 65). But the writer has not been able to find this statement in the ancient medical classics. It is mentioned in the *Mahavagga* that the education of Jivaka at Taxila lasted seven years. The duration of the studies depended on the ability of the student to master the *sāstras* and practical training, and no set period seems to have been prescribed.
- ⁶² "The Laws of Manu". English translation by G. Buhler, 10. 8. 47. *The Sacred Books of the East Series*, Vol. XXV. The Clarendon Press, Oxford, 1886.
- ⁶³ Arrian, "India", p. 15.
- ⁶⁴ Kaegi, A. "The Rigveda". Ginn and Company, Boston, 1886. pp. 82-83.
- ⁶⁵ "Mahavagga". *Kandhaka VIII*.

CHAPTER I

- ¹ Garrison, F. H. "An Introduction to the History of Medicine", p. 71, Philadelphia, 1929.
- ² Neuburger, M. "History of Medicine", Vol. I, p. 48.
- ³ Hoernle, A. F. R. "Medicine of Ancient India", *Osteology*, p. 3.
- ⁴ Neuburger, M. "History of Medicine", Vol. I, p. 104.
- ⁵ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 312, footnote 3.
- ⁶ The writer is indebted to Hoernle's "Osteology" for the material and discussions of this section.
- ⁷ Hoernle, A. F. R. "Medicine of Ancient India", *Osteology*, p. 22.
- ⁸ Hoernle, A. F. R. "Medicine of Ancient India", *Osteology*, pp. 86-87.

- ⁹ Chāndogya Upanishad — English translation. "The Three Principal Upanishads" by Shree Purohit Swami and W. B. Yeats, p. 111. 1952.
- ¹⁰ Madhava Sastri. "Samānya Vedānta Upanishads", Subhala Upanishad, Chapter IV.
- ¹¹ Seal, B. N. "Positive Sciences of the Ancient Hindus", Chapter on Physiology and Biology, 1915.
- ¹² Dasgupta. "A History of Indian Philosophy", Vol. II, p. 291.
- ¹³ Sūśruta (S.S. III. 7. 13) mentions the colour of the sirās as yellowish red, blue, white and red. In A.V. X. 2. 11, we read "who stored in him floods, moving in all diverse directions and formed to flow in rivers pink, rosy red, coppery dark, running in all ways in man and upwards and downwards." It is doubtful whether this description points to a differentiation of arteries and veins.
- ¹⁴ Chakraberty, Chandra. "An Interpretation of Ancient Hindu Medicine", p. 36. 1923.
- ¹⁵ Neuburger, M. "History of Medicine", Vol. I, p. 48.

CHAPTER II

- ¹ Seal, B. N. "Positive Sciences of the Ancient Hindus", Chapter on Physiology. 1915.
- ² "Sarāngadhara Samhita", Pūrva Khanda, Chapter V, pp. 49-50. Sanskrit Edition. The Nirṇaya-sagar Press, Bombay.
- ³ Brock, A. J. "Greek Medicine", p. 5.
- ⁴ Neuburger, M. "History of Medicine", Vol. I, p. 152.
- ⁵ Neuburger, M. "History of Medicine", Vol. I, p. 153.
- ⁶ "The Works of Aristotle", Vol. V. De Partibus Animalum by W. Ogle, Book III. 5. 667, footnote 2.
- ⁷ "The Works of Aristotle", Vol. V. De Partibus Animalum by W. Ogle, Book II. 1. 646.
- ⁸ Allbutt, C. "Greek Medicine in Rome". Macmillan & Co., Ltd., London, p. 315.
- ⁹ "The Works of Aristotle", Vol. V. De Partibus Animalum by W. Ogle, Book III. 5. 668. English Translation. The Clarendon Press, Oxford. 1949.

CHAPTER III

- ¹ Zimmer, H. R. "Hindu Medicine", p. 133.
- ² Zimmer, H. R. "Hindu Medicine", p. 134.

- ³ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 334.
- ⁴ The Bower Ms., Part I, p. 93.
- ⁵ The Bower Ms., Part I, p. 93, note.
- ⁶ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 333.
- ⁷ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 337.
- ⁸ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 336.
- ⁹ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 337 Footnote.
- ¹⁰ Dasgupta, S. "A History of Indian Philosophy", Vol. II, p. 332.

CHAPTER IV

- ¹ The Egyptians held a view similar to that of Charaka about the ducts of the body. The term used in the Papyri for the ducts is *metu*. Sigerist defines the term as vessels, pipes through which everything moves, that is, in motion in the body. Charaka uses the word *srota* to denote the same structures. No attempt was made by the Egyptians or by Charaka to differentiate the vessels into blood-vessels, nerves, lymphatics, ducts and canals. The functions of the *metu* are to carry air, liquids, such as blood, urine, tears, sperm, and solid matters, such as faeces. Charaka attributes the same functions to the *srotas*. In Egyptian medicine abnormal conditions of the *metu* were considered the cause of disease. Refer the writer's article on "Tubular System of the Body : Ancient Egyptian and Indian Views". Indian Journal of the History of Medicine, Vol. II, No. 1, pp. 13-20. 1957.

CHAPTER V

- ¹ Neuburger, M. "History of Medicine", pp. 16-17.

CHAPTER VI

- ¹ "A Sketch of Medicine and Pharmacy" by Samuel Evans Massengill, p. 16. The Massengill Company, 1943.
- ² Sigerist, H. E. "A History of Medicine" Vol. I, p. 485.
- ³ Sigerist, H. E. "A History of Medicine", Vol. I, p. 486.

- ⁴ Opium appears to have been brought into India by the Mussulmans, as its Sanskrit *ahipena* is evidently derived from the Arabic *afyun* and it is not mentioned by the older Sanskrit writers.
- ⁵ "Mercury, though not mentioned by Charaka and Susruta, has in later days come to be regarded as the most important medicine in the Hindu Pharmacopoeia. The Sanskrit name for Mercury is *Parada* and it literally means that which protects, and mercury is so called because it protects mankind from all sorts of diseases. The term 'rasa' occurs in one passage in Charaka Samhita. It signifies mercury as well as myrrh, sulphur, gold, etc. Therefore, it is doubtful if Charaka meant mercury by the term *rasa*. Supposing, however, he did mean mercury, its use was at all events, in his time, confined to skin diseases only." "The Materia Medica of the Hindus" by U. C. Dutt. Thacker Spink and Company, Calcutta. 1877.
- ^{6 & 7} The writer is indebted to "The Materia Medica of the Hindus" by U. C. Dutt, for these two lists.

CHAPTER VII

- ¹ It was one of the basic principles of ancient Indian medicine that a physician should ascertain before the commencement of treatment whether the disease is curable or not, and then undertake the treatment of only curable diseases. With the rise of the school of *Rasasiddhas*, sometime after the 11th century, this principle was denied. The term *rasa* signifies mercury, sulphur, gold, etc., and in *rasa chikitsa*, mercury and mica were used to a great extent in preference to the drugs used by Charaka and Susruta. The *rasasiddhas* claimed that there was no need for the division of diseases into curable and incurable, since the *rasa* compounds are capable of curing all kinds of diseases. They even asserted that one who resorts to *rasa chikitsa* should not take into consideration the question of disease and the *doṣas* producing it. These *rasasiddhas* deny the basic principles of classical medicine, such as the *tri-doṣa* theory and the theory of *rasa*, *vipāka*, *vīrya* and *prabhāva*. Whatever the claims of *rasasiddha* may be, it is not classical Indian medicine.
- ² It is interesting to note the qualities which the patient should possess. He must have a curable disease. He must be able to afford the cost of the treatment and he must obey impli-

citly the instructions of the physician. The burden of cure is laid on the shoulders of the patient and the physician is not too confident of his skill.

- ³ See pp. liii and liv of General Introduction.

CHAPTER VIII

- ¹ Zimmer, H. R. "Hindu Medicine", p. 56.
- ² Zimmer, H. R. "Hindu Medicine", p. 177.
- ³ Neuburger, M. "History of Medicine", pp. 9 & 10.
- ⁴ Neuburger, M. "History of Medicine", p. 58.
- ⁵ As far as the writer is aware, no mention is made of blood transfusion either in Susruta or Charaka. So this reference to drinking animal blood to replace the blood that is lost is interesting. The principle of replacing the blood lost by blood from other sources seems to have been recognised and the replacement of the blood lost by animal blood, if not by human blood, seems to have been practised in the surgical school.
- ⁶ "The Laws of Manu". English translation by G. Buhler, Sacred Books of the East, Vol. XXV. 8. 125.
- ⁷ Jolly Julius. English translation by C. G. Kashikar, p. 168.
- ⁸ The writer is indebted to "Ophthalmology of the Ayurvedists" by K. S. Mhaskar for some of the material of this section. Mhaskar in this article gives a very good account of the origin, development and knowledge of the ophthalmology of ancient Indian medicine. Journal of Indian Medical Association, September 1931.
- ⁹ Mādhava deals with eye-diseases in the 59th Nidhana. Mādhava Nidhana by M. Duraiswamy Iyengar, Tamil translation, 1936.
- ¹⁰ Mhaskar, K. S. "Ophthalmology of the Ayurvedists".

CHAPTER IX

- ¹ Mādhava in the 62 *nidhanam* enumerates twenty diseases of the *yoni*. He divides them into four classes like Susruta II, based on the *doṣa vaiṣamya*, *vātala*, *pittala*, *sleshmala* and due to all three *doṣas*. In his enumeration he follows Susruta in the first three classes, but in the class due to the three *doṣas* he mentions *shandi*, *andala*, *vivruta*, *suchivaktara* and *sannipāthaja*. The diseases of women were traditionally believed to number twenty, though the diseases included in this count varied with the different authorities.

- ² Mādhava Nidana, 64 nidhanam, 3-5.
- ³ Jīvaka was the court physician of King Bimbisara. Many wonderful cures performed on grown-up persons are related of him but none with reference to children in the Mahavagga. But he bore the title of *kaumāra-bhṛtya* (Pali, *komara bachcha*) i.e., children's doctor. This surmise is supported by the fact that the Navanītaka cites two formulae attributed to Jīvaka and these refer to children's diseases. Bower Ms. Part II, Chapter 14. Note on 1081.

INDEX

A

- Abdomen (*Koṣṭha*), penetrating wounds of & treatment, 167
- Abortion (*Garbhavichyuti*), causes of, 189, 190
definition, 189
incipient, 190
missed & its varieties, 190, 191
signs & symptoms of, 190
treatment of, 190
- Āgāda Tantra*, iii, xvii, xxvii.
- Agni* (*Bhūta*), 58
- Agnivesa*, ii, xviii
- Agnivesa-tantra*, xxviii
- Āhāra-Prasāda*, 39, 58
- Āhāra-Rasa*, 39
- Āharyā* (Extraction), 156
indications for, 158
- Ākāsa* (*Bhūta*), 58
- Ālepa* (a variety of paste), 163
indications for its use, 163
- Alexander, the Great, invasion of India & its effects, xxxix
- Allbutt, Clifford, T., xxxviii
- Ālochaka Pitta*, location, function & results of derangement, 69
- Āmāsaya* (stomach), anatomy of, 31.
- Amenorrhoea*, primary, 180
secondary, 180
- Anatomy :
antiquity of its study, 1
its importance to medicine & surgery, 32, 145
schools of, 2
tradition, 1
- Andha-pūtanā Graha* : signs & symptoms of its attack, 200, 201
- Angiology (ancient Indian), 23-29.
- Animal products : classification of, 110.
- Animism in surgery, 157
- Animistic beliefs in Gangetic valley, 6th century B.C., viii
- Anumāna* (inference), xxiv, xxv, 93, 95
- Anuvāsan vasti* (oily enemata), 138
- Āpāna-vayu* : Location, functions & results of derangement, 69
- Āpatarpana*, treatment, 141
kinds of, 141
- Āptopadesa* (instruction of the inspired), xxiv, xlv, 93, 94
- Aṛiṣṭa* (prognostications of death), 103
- Aṛiṣṭa* (form of medicine), 125, 126
- Aristotle, views on digestion, etc., 54, 55, 56
- Ārtava* (menstrual blood), characteristics of normal, 183.
- Arunadatta, xxxvii
- Aryan invasion of India, iii
- Asmarī* (urinary calculi), see Calculi, urinary.
- Aṣṭāṅga Āyurveda*, iii, xvii, xix
- Aṣṭāṅga Samgraha*, xxxv
- Aṣṭāṅga Hṛdaya Sambhita*, xxxv
- Āsthāpan-vasti* (dry enemata), 138
- Asthi* (bone), see Bone
- Asthi-samghata* (joints), see Joints.
- Asvini-kumaras, i, iii
- Atharva-veda :
contents of the hymns of, xi
different collections of, xxvii
diseases mentioned in, xii
medical lore contained in, xiii
medical practice in, xiii

- religion of, x
- as a source of Indian medicine, x, xxviii
- treatment of diseases in, xi
- Atharvan (priest physician), xiv
- Ati-yoga* (excessive association), 76
- Ātreya Punarvasu, ii, xviii
- Ātreya school of medicine, xv, xx, xxvii
- Aupadhenava, xviii
- Aourabhara, xviii
- Avalambaka-kapha*, location, functions & results of derangement, 70
- Ayoga* (deficient association), 76
- Āyurveda :
 - aṣṭāṅga Āyurveda, xvii, xix
 - different versions of its origin, i-iii
 - divisions of, iii
 - existence of, i
 - meaning & scope of, xix

B

- Bandages (*bandha*) :
 - application of, 164
 - indications for its use, 163, 164
 - varieties of, 163
- Benaras or Kasi University, xviii
- Bhaghnām*, see Fractures & Dislocations.
- Bhāradvāja, i, ii
- Bhedya* (excision), 156
 - indications for, 158
- Bhela, ii, xviii
- Bhela Samhita, xxviii
- Bhoja, xviii
- Bhrājaka-pitta*, Location, functions & results of derangement, 69
- Bhūtas, pancha* (elements), xx, xli, 34, 58, 65
- Bhūta-vidya*, iii, xv, xvii, 177

- Bladder, urinary (*vasti*) :
 - descriptions of, 31
 - ducts of, 31
 - Location, 31
- Blood (*rakta*) :
 - characteristics, 45
 - circulation of, 46-50
 - colour of healthy & vitiated, 45
 - derangement, causes of, 77, 78
 - as a dhātu, 34, 45
 - as a doṣa, 62
 - functions of, 45
- Blood-letting (*sirāvyadha*) :
 - indications & contra-indications for, 163
 - means of, 162
- Bodhaka-kapha*, location, functions & results of derangement, 70
- Body (human) :
 - composition of, 34, 35
 - parts of, 12
- Body-fire, 53
- Bolling, G. R., xiii, xiv
- Bones (*asthi*) :
 - classification of (Charaka's), 7
 - classification of (Susruta's), 7, 12
 - comparative table of ancient & modern systems, 8-11
 - as a dhātu, 34, 41, 58
 - fractures & dislocations, 164
 - functions of, 42
- Bower Manuscript :
 - contents of, xxxii
 - date of, xxxiii
- Brahma, 1, 65
- Brahmanas, xv, xvi
- Brahmana-Upanishad period, xv, xvi.
- Brain (*mastiṣka*), 52
- Brimhana* (method of treatment), indications for, 138, 139
- Buddha, xviii, xxxii
- Budbuda*, 5

C

- Caesarean section, indications for, 194
- Calculi, urinary (*asmari*) :
operation for & its description, 167, 168
signs & symptoms of, 167
- Cataract, operation for, 170
- Caustics :
action of, 161
strength & uses of, 162
- Cautery (*agni, agnikarman*) :
different ways of cauterisation, 162
grades of cauterisation, 162
indications for use, 162
- Caya (stage of accumulation of *doṣas*), 71
- Chakrapānidatta, xxviii, xxxvi
- Chāndogya Upanishad, xv, 23, 65
- Chanhu-dāro, iv
- Charaka, date of, xxix
- Charaka samhita, xviii, xix, xxix-xxx
- Chhedya (incision), 156, 158
- Children :
diseases due to derangement of *doṣas*, 199
diseases due to the influence of malignant stars (*graha*), 199-201
diseases due to teething, 199
- Circulation :
of blood & views on it, 46-50
of *rasa*, 47
- Civilisation :
Cretan, ix, x
Egyptian, ix
Hindu, vi
Indus, iv-viii
Mesopotamian, ix
- Commentators & their dates, xxxvii
- Conception :
factors necessary for, 184

symptoms manifest on, 184
see also Pregnancy.

Constitutions, *see* Temperaments

Cupping, method of performing, 162

D

- Dalhaṇa, xxx, xxxi, xxxvii, 47, 73
- Dasgupta, x, xiii, xiv, 27, 28
- Dawson, W. R., ix
- Dāyus & Dāsas, v, viii
- Death, prognostications of, *see Ariṣṭa*
- Dhamanis :
distribution, 25
functions, 24, 29
number, 24, 25, 26
origin of, 24
- Dhanvantari, ii
school of medicine, xv, xviii
- Dhātus :
definition, 34
formation, 34, 42, 58
functions of, 42
mala, 43, 60
number, 34
prasada, 58, 60
- Dhātu-sāmya, xx, 35, 58
- Dhātu-vaiṣāmya, 35, 58
- Dhūpana (fumigation), methods of application, 128, 129
- Diagnosis :
factors involved in, 90-93
importance of, 90
methods of, 93-96
problems of, 96-99
- Diet :
dietetic regulations in various seasons (*ṛtucharya*), 132, 133
its importance in treatment of diseases, 141
its part in production of disease, 131, 132
its role in health, 131

Digestion :
description of the process of,
39, 40
kinds of, 40

Digestive fire, 39, 53

Dinacharya, xx, 130-131

Diseases :

aetiology of, 76-77

classification of (Charaka's),
79, 80, 81

classification of (Susruta's),
80, 81

pathology of, 82-89.

primary & sympathetic, 98

prognosis of, 99-106

treatment of, 98

Diseases : curable & its characteristics, 135

curable but with difficulty &
its characteristics, 135

incurable & its characteristics,
136

Diseases of children : *see* Children, diseases of.

Diseases of female generative organs : *see* *Yoni vyapat*.

Diseases mental :

treatment, 142-143 ; varieties,
142.

Dislocations (*sandhi-muktham*) :

signs & symptoms, 164

varieties, 164

Dissection of the human body :
its importance to physicians &
surgeons, 32, 145

method of, 2

Doṣas :

definition, 60

nature of, 72, 73

normal & abnormal functions
of, 68

number & varieties, 69, 70

origin of, 67

role in production of diseases,
70, 71

seats of, 67

steps through which *doṣas*
pass in production of diseases,
71

Doṣa-sāmya, 60

Doṣa-vaiṣāmya, 60

Dravidians, The, iv

contributions to Hindu culture,
vi

language, v

Dravya (Material substances) :

definition of, xxii

Dreams, their import in prognosis,
105

Dr̥dhabala, xxviii, xxix

Dropsy (*udara*) :

operation for, 169, 170

varieties, 169

Ducts, urinary, 31

Dūṣyas, 59, 60, 82

E

Embryo, The :

formation of, 2

Embryotomy, 193, 194

Empirico-rational medicine, xv,
xvii

Enemata (*vastikarman*) : *see*
Āsthāpan & Anuvāsan.

Epoch of mental stir, xvi

Eshya (probing), 156

indications for, 158

Evacuation of fluids (*visravaya*) :
see *Visravaya*

Excision (*Bhedya*) : *see* *Bhedya*

Exercise, bodily (*vyāyāma*) :
see *vyāyāma*.

Extraction (*āharyā*) : *see* *Āharyā*

Eye diseases :

aetiology, 175

description of individual diseases,
173-175

number & location, 172, 173

signs & symptoms, 175

treatment general, 175

treatment surgical, 175, 176

F

- Fallopian tubes, The : description of, 178
 Fever, pathogenesis of, 88
 Fire (*agni*, *tejas*) :
 as a *bhūta*, 58
 bhūtāgni, 41
 body-fire, 53
 dhatvāgnis, 53
 digestive, 39, 53
 Foetus, The :
 development of, 2-6
 signs pointing to the death of, 191
 signs pointing to the sex of, 184, 185
 views on development, 2-6
 Food : functions of, 35-36
 composition of, 36
 metabolism of, 40
 qualities of, 36
 Fracture (*kāṇḍa-bhagnam*) :
 general signs & symptoms of, 165
 treatment of, 166
 treatment of faulty union, 166
 varieties of, 165
 Fracture-bed, 166

G

- Garbhāsaya* (uterus), see Uterus
Garbha-pāta (miscarriage), see Miscarriage
Garbasthāpana (prevention of abortion), 190
Garbavichyuti (abortion), see Abortion.
Garbha-upanishad, 4, 5
 Gonds, The, iv
 Gopatha-Brahmana, xv
 Gopurarakshita, xviii
 Grahas :
 description of *graha* diseases, 200, 201
 diseases caused by, 199
 number of, 199

- origin of, 199
 signs & symptoms of *graha* diseases, 199-201
 treatment of, 201
 Greek medicine : relation between ancient Indian & Greek medicine, xxxvii-xliv
Gudam (rectum), see Rectum
Gulma (abdominal tumours) :
 pathogenesis of, 88
Gunas (qualities) : number and enumeration of, xxii-xxiii
 Gupta period, xxxix
 Gynaecology, 179-183

H

- Harappā :
 culture & civilisation, v, vii
 excavations, x
 relics, vi, vii
 religion, vii
 sanitation & hygiene, x
Hārīta, ii, xviii
 Heart (*hṛdaya*) : functions, 44
 seat of consciousness, perception & *manas*, 45
 Hellenism, its impact on India, xxxix
 Hippocrates, xl, xliii
 Hoernle, A. F. H., viii, xxvii, xxix, xxxi, xxxii
 Hopkins, E. W., xliii
 Humors :
 of Greek medicine, xli, 66
 of Indian medicine, xli
 Humoral theory :
 of Greek medicine, xl
 of Indian medicine, xlii

I

- Indus Valley Civilisation :
 authors of, v
 contact with other civilisations, ix
 date of, iv
 medical beliefs of, x

- relation to Aryan civilisation, v
- religious beliefs of, vi, vii
- sanitation & town planning, x
- script of, iii
- Incision (*chhedya*), see *Chhedya*.
- India, prehistoric, iii
- Indra, i, iii
- Infants : diseases of, 199
- general care of, 195
- Inflammation : diagnosis & treatment of, 163
- Inge, Dean, xxxviii
- Instruments, surgical :
 - description of, 159-160
 - kinds of, 159
 - see also Sastras & Yantras
- Intestines (*pakvāsaya*), small & large, 31

J

- Jātakas, Buddhist, xviii
- Jātukarna, ii
- Jīvaka, xxxvii, lii, liv, 194
- Joints (*asthi-samghata*) :
 - classification, 17, 18
 - description, 18
 - number, 17
- Jolly, Julius, viii, xxxviii
- Jones, Sir William, vii, xxxix

K

- Kalās* : their number & description, 6
- Kalala*, 5
- Kalpas, The, xxvii, xxviii
- Kandaras*, 22
- Kānda-bhagnam* (fractures) : see Fractures.
- Kanishka, King : date of, xxix, xxx, xxxix
- Kapha* (phlegm) :
 - attributes, normal & abnormal, 68

- causes of derangement, 78
- function of, 69
- production of, 67
- seats of, 67
- varieties of, 69, 70
- Karma (movement) : kinds of, xxii
- Kāsyapa, xxvii, lii, 61, 194, 199
- Kaumara-bhṛtya (paediatrics) :
 - its antiquity, 194
 - scope of, 194
- Kayachikitsa (internal medicine), iii, xxvii
- Khonds, The, iv
- Kiṭṭa*, 59, 60
- Kledaka-kapha* : location, function & results of derangement, 69, 70
- Kloma* (lungs) : see Lungs.
- Koches, The, iv
- Kolarians, The, iv
- Kols, The, iv
- Kṣīrapāni, ii, xviii
- Ktesias, xxxviii
- Kushan dynasty, xxxix

L

- Labour, normal :
 - clinical course of, 186
 - signs of imminent, 186
 - stages of, 186, 187
- Labour, difficult (*mūdhā-garbha*) :
 - causes of, 191
 - classification, Mādhava's, 192
 - classification, Susruta's, 192
 - management, when the foetus is living, 192, 193
 - management when the foetus is dead, 193, 194
 - symptoms of, 191, 192
- Langhana* (method of treatment), 138, 139
- Laparotomy, 166
- Leeches (*jaluka*) : indication for application of, 162
- Lekhya* (scarification) : indications for, 158

Life :

- characteristics of long life, 102
- indications for ascertaining the remaining period of life, 103

Linghanāsha (blindness) :

- preliminary stages of, 174
- varieties of, 174

Lina-garbha (missed abortion), 190

Literature, medical :

- periods of, xxvii
- period of kalpas, xxvii
- period of samhitās, xxviii
- period of tantras, xxvii

Lithotomy : description of operation, 167, 168

Liver & Spleen, 43

Lungs (*kloma*, *pupphusa*), 30, 31

M

Macdonnell, A. A., ix

Macrocosm & Microcosm :

- parallelism between, 61

Mādhavacharya : date of, xxxvi

- Nidāna, xxxv

Magico-religious medicine, x, xiv, xvii

Mahabharata, The, xliii

Mahavagga of Vinaya-pitaka, xxxvi, xliii

Majja (bone marrow) :

- as a dhātu, 34
- kinds of, 32

Makkalla : definition, 188

- garbha*, 188

- prasuti*, 188

Malas (waste products), 43

- theory of, 43

Māmsa-dhātu, 34*Manas* (mind) : see Mind*Marmas* : definition of, 33, 146

- location of, 146

- number & classification, 146

- results of injury to, 146

- tables of distribution & results of injury, 147-152

Materia-Medica :

- ancient Indian, 107

- Egyptian, 111, 112

- Mesopotamian, 112

- Vedic, 109

Material objects (*dravya*) :

- classification of, 110, 111

- properties & use in medicine, 113

Mauryan Dynasty, xxxix

Medas (fat), 34

Medicine :

- analogies between Greek & Indian medicines, xxxviii

- classical Indian, xvii-xxi

- Cretan, x

- Egyptian, ix

- empirico-rational, xv, xvii

- Indus civilisation, ix, x

- magico-religious, x, xiv, xvii

- Mesopotamian, ix

- post-Vedic, xv-xxi

- prehistoric Indian, iv

- relation between Greek & Indian, xxxvii-xliv

- Vedic, x-xv

Medicine, ancient Indian :

- origin, mythical, i-iii

- origin, traditional, xvii-xviii

- schools of, xv, xviii

- sources of, xxvi-xxxvii

Medicines :

- classification, general, 110, 111

- classification, Charaka's, 122

- classification, Susruta's, 121

- different modes of application, 126-129

- forms of, 124-126

Mediterranean, The, iv

- varieties of, v

Megasthenes, xxxviii

Menstruation :

- commencement of, 179

- cessation of, 179

- disorders of, 179-181

- hygiene of menstrual period, 176
- Metrorrhagia : see *Pradara*.
- Milk :
 breast & its characters, 197
 characters of vitiated milk, 197
 composition & characteristics of, 196, 197
 conditions which affect composition of breast, 197
 cow's milk & its characteristics, 198
 diseases caused by vitiated, 197-198
 disorders of secretion of, 197
 goat's milk & its properties, 198
- Mind (*manas*), 30, 52
- Mineral objects : classification of, 110
- Miscarriage (*garbha-pāta*) : definition, 189
- Mithyā-yoga*, 76
- Mohenjo-dāro :
 archaeological discoveries at, iv
 sanitation & hygiene of, x
 script of, iii
- Mongoloid, The, iv
- Mūḍha-garbha* : see Labour, difficult.
- Mukhāmandikā-grāha* : signs & symptoms of attack, 201
- Munda language, The, iv
- Muscles of the human body (*pesi*) : number & distribution, 18, 19
- N**
- Nagārjuna, xxxi
- Nāgodara* (missed abortion) : description of, 190
- Naigameṣa grāha* : signs & symptoms of attack, 201
- Nāya* (nasal medicaments) : classes of, 127
- Navanītaka : contents of, xxxii
 date of, xxxii
 importance of, xxxiv
 sources of, xxxii-xxxiv
- Nyaya school of philosophy, xxi, xxiv, xxv
- Negrito, The, iii
- Neolithic Age in India, iii
- Neuburger, Max, ix, 1, 32, 100
- Neurology, ancient Indian :
 anatomy of the nervous system, 29, 30
 cranial nerves, 30, 52
 physiology of the nervous system, 52, 53
- Newborn : care of, 194, 195
 diseases of, 198
- Nidānas* (predisposing causes) :
 forms of, 77
 mode of action, of, 77-82
 role in production of disease, 82, 85
- Nidāna* (cause & effect relation), xxv
- Nordic, The, iv
- Nourishment of the body : principles of, 38
- O**
- Obstetrics, 183-194
- Oils :
 methods of use & preparation, 126
 their use in medicine, 139
- Ojas* : function of, xiv
 production of, 40, 47, 50
 views on, 47
- Omens : their value in prognosis, 102
- Operations, surgical :
 classification of, 156
 preliminary & after measures, 156, 157
 preparation for, 157
 varieties & indications for each, 158, 159
- Ophthalmology, 171-176

Oraons, The, iv
 Original inhabitants of India, iv
 Osteology, ancient Indian :
 Ātreya-Charaka's version, 7
 Susruta's version, 7, 12
 Table, comparative, of ancient
 Indian & modern systems,
 8-11
 Otoplasty, 168

P

Pāchaka-pitta : location, functions & results of derangement, 69
 Paediatrics, ancient Indian : see *Kaumara-Bhṛtya*.
 Paleolithic Age in India, iii
Panchabhūtas, xli, 34, 58, 66, 116
Panchakarman, 138
Parāsara, ii, xviii
 Paracentesis, abdomen : method of performance, 169
 precautions to be taken, 170
 Pastes : varieties & their use, 163
 Pelvis : anatomy of, 178
Pesi : see Muscles of the human body
 Philosophy, ancient Indian :
 relation to classical medicine, schools of, xxi-xxvi
 Physician in ancient India :
 aim of, li
 classes of, li, lii
 conditions of practice, liii
 qualification of, liv
 status of, l-lii
 training of, xlv-l
 Physiology : analogy between Greek & Indian views, 54-56
Pinda, 5
Pitta (bile) : attributes, normal & abnormal, 68
 causes of derangement, 78
 functions of, 69
 production of, 67
 seats of, 67
 varieties of & their functions, 69
Placenta (*apara*) : retained, method of expressing it, 187
Plīhodara (a variety of *udara*) : dropsy associated with enlargement of the spleen, 169
 Post-Vedic medicine, xv-xxi
Poushkalavata, xviii
Prabhāva of drugs, 115
Pradara (Metrorrhagia) : causes, signs & symptoms, 180
Pradeha (paste) : definition, 163
 action, 163
Prajāpathi, i, iii
Prakopa (stage of excitation of *doṣas*), 71
Pralepa (paste) : definition, 163
 use, 163
Prakṛti (temperaments) : see Temperaments.
Pramanas (special means), xxiv, 93
Prameha (urinary affections) : pathogenesis of, 88
Prana Vāyu : location, functions & results of derangement, 69
Prasāra (fermentation of *doṣas*), 71
Prasuti-Makkalla : see *Makkalla*
Pratyakṣa (perception), xxiv, 94
 Praxagoras, xliii
 Probing (*eshya*) : see *Eshya*.
 Proto-Australoids, The, iii
Puerperium (*sūtikā*) :
 diseases of, 187, 189
 management of, 187
Puncture (*vedhya*) : see *Vedhya*
Pupphusa (lungs) : see Lungs
Pūrva rūpa (premonitory symptoms), 71, 96, 98
 Pythagoras, xliii

Q

Quacks :
 cause of their prevalence, lii

the harm they cause to people,
liii

tricks of their trade, liii

R

Races of prehistoric India, iii, iv

Rakta (blood) : see Blood.

Rakta Gulma : causation, 188
differential diagnosis from
pregnancy, 189

signs & symptoms, 189

Ranjaka Pitta : location, func-
tions & results of derange-
ment, 69

Rasa-dhātu, 40

Rasas (tastes) :

importance in medicine, 115,
116

number & qualities, 118

theory of *rasa*, *vipāka*, *vīrya* &
prabhāva, 120

Rasāyana Tantra, iii

Rasāyana medicines :

definition, 123

preparation, 123

Rawlinson, H. G., vii

Rectum (*gudum*) : description
of, 31

Regimen of life : its importance
in prevention of disease, xx
its importance in treatment,
141

Respiration : views on, 50, 51

Revaṭi-graha : signs & symptoms
of its attack, 200

Rhinoplasty : method of per-
forming, 168, 169

Rhys Davids, T. W., viii, xvi

Rigveda :

date of composition, xv

nature of its hymns, vii

relation to *Atharva-veda*, vii

Royle, J. F., viii

Rtucharya (regimen pertaining
to seasons), 132, 133

Rūkshana (method of treat-
ment) : indications for, 139

Rūpa (fully-fledged disease), 71

S

Sādaka-pitta : location, func-
tions & results of derange-
ment, 69

Sadvṛtta (good conduct), 134

Sakthi (leg presentation) : its
correction, 193

Sakuni-graha : signs & symptoms
of its attack, 200

Salya : derivation of the word,
144

relation to surgery, 144

Salya-tantra of *Ayurveda*, iii

Salya-tantra of *Susruta*, xxvii,
xxx

Sālākya-tantra of *Āyurveda* :
scope of, iii

Sālākya-tantra of *Nemi*, xxvii

Samāna vāyu : location, func-
tions & results of derange-
ment, 69

Sāmānya (generality), xxii, xxiv

Samavāya (inseparable inher-
ence), xxiii

Samhitas :

Aṣṭāṅga Hṛdaya, xxxv

Bhela, xxviii

Charaka, xxviii, xxix

Hārīta, xxviii

Susruta, xxx

Samhita period, xxviii

Samkhya philosophy : its rela-
tion to classical Indian medi-
cine, xxi

Samsamana :

class of medicines, 121, 140

method of treatment, 141

Samsodhana :

class of medicines, 121

method of treatment, 141

Sandhi-muktham (dislocations) :

number, 164

signs & symptoms, 164, 165

types of, 164

Santarpana (method of treat-
ment), 141

Sārangadara, 51

- Sargon of Agada, iv
Sastras (sharp surgical instruments) : kinds of, 160
 size & make, 161
 uses of each kind, 160-161
Satapatha Brahmana, xxxi
Savaras, The, iv
Scarification (lekhya) : see *Lekhya*.
Seasons, 132, 133 : see also *Rtucharya*
Semen (sukra) : see *Sukra*
Sigerist, Henry, E., xiv
Sīmanta (synovial membrane), 22
Sirās : distribution of, 26
 functions of, 26, 27, 28, 56
 number of, 26
Sirāvyadha (blood-letting) : see *Blood-letting*
Siro-vasti : ways of application, 127
Śitapūtānā graha : signs & symptoms of its attack, 201
Sīvyā (suturing) :
 indications & contra-indications for, 159
 kinds of, 159
 materials used in, 159
Skanda graha : signs & symptoms of its attack, 200
Skanda-Āpasmarā graha : signs & symptoms of its attack, 200
Skeleton, human : sources of knowledge about, 6, 7
Sleşaka kapha : location, functions & results of derangement, 70
Sleşma : see *Kapha & Soma*.
Smith, Vincent, A., xxxix
Snāyus (ligaments) :
 functions of, 22
 kinds of, 22
 number of, 22
Snehana (method of treatment) :
 its indications, 139
Soma : see *Kapha & Sleşma*
Sphik (buttock presentation) :
 its correction, 193
Srotas : functions, 27
 number, 27
 origin, 27
Sthāna-samshraya (location of doṣas in various places), 85
Stomach (āmāsaya) :
 description of, 31
 functions of, 55
 location of, 31
Sukra (semen), 34, 183
Sthambana (method of treatment) : its indications, 138
Subhala upanishad, 23
Surgery :
 achievements of, 166-170
 importance of, 144
 position of, xx, xxi
 plastic, 168, 169
 scope of, 145
 training in, xlix
Susruta, the elder : date of, xxxi
salya-tantra of, xxx
Susruta samhita, xxx
Susruta, the younger :
 his identity, xxx
Uttara-tantra of, xxx
Sūthikā (puerperium) : see *Puerperium*.
Sūthikā-roga : see *Puerperium*, diseases of.
Suturing (Sīvyā) : see *Sīvyā*
Swedana (method of treatment) :
 its indications, 139, 140
Swedana : methods of application, 128
- T**
- Takṣasilā (Taxīla)* : university of, xviii
Tantras, xxvii
Tarpaka kapha : location, functions & results of derangement, 70
Teething :
 diseases attributed to, 199

- formulae for diseases caused by, 199
 time of, 199
Tejas : see Fire
 Temperaments (*prakṛti*), 63-66
 Theory of :
 malas or waste products, 43
 pañcabhūta, xli
 of *rasa*, *vipāka*, *vīrya* & *prabhāva*, 115, 116
 tridoṣa, xliii
Todas, The, iv
 Treatment :
 of bodily diseases, 140-143
 of mental diseases, 142-143
 methods of, 138
 objects of, 138
 periods of (*kārya-kālas*), 137
 requisites of, 136
 Tribes, aboriginal of India :
 chief representatives of, iv
 classes, iv
 customs & beliefs of, iv
Tridoṣa doctrine : see Theory of *Tridoṣa*

U

- Udāna vāyu* :
 location, functions, 7
 results of derangement, 69
Udara (dropsy) : see Dropsy
Upa-dhātus, 42
Upanishads, The, xv
Upayantras, 160
 Urine : in diabetes, 94
 function, 44
 production of, 44
 varieties of & their characteristics, 44
 varieties of *prameha* (urinary affections) & the nature of urine in each affection, 88
 Uterus (*garbhāsaya*) :
 abnormal conditions of gravid, 189
 anatomy of, 32, 178
Uttara-tantra, xix, xxviii, xxx, 73

V

- Vāgbhaṭa* I, xxxiv, xxxv
Vāgbhaṭa II, xxxvi
Vagina (*yoni*) : description of, 178
Vaiśeṣika philosophy :
 doctrines of, xxii-xxiv
 indebtedness of Indian medicine to, xxi
Vājīkarna-tantra, iii, xvi
Vājīkarna medicines :
 definition, 153
 prescriptions for, xvi, 153
Vamana (one of Panchakarman), 138
Vas deferens : anatomy of, 32
Vastikarma (enemata) :
 description of the tube used for, 126
 methods of application, 126, 127
 varieties of, 138
 see also *Āsthāpan* & *Anuvasan*
Vāyu :
 attributes of, normal and abnormal, 68
 causes of derangement, 77
 functions of, 68, 69
 production of, 67
 seats of, 67
 varieties of & their functions, 69
Vedas, The, i
Vedhya (puncture) : indications for, 158
 Vegetable products : classification of, 110
 Venesection (*sirāvyadha*) : see Blood-letting.
Vidyas : *Bhūta*, xv, xvii
 pitṛya, xv, xvii
 sarpa, xv, xvii
Vikṛti, 62
Vipāka, 114, 115
Virechana (one of Panchakarman), 138
Vīrya, 114, 115

- Viśeṣa* (diversity), xxiii
Visravya (drainage of fluids),
 156, 158
Vyāna vāyu : location, functions
 & results of derangement, 69
Vyāyāma (bodily exercise), 134

W

- Waste products (*malas*) : see
Malas.
 Western Brachycéphals, The, iv
 Weber, A., xl
 Wet-nurse :
 necessity for, 196
 qualities of, 196
 selection of, 196
 Wheeler, Mortimer, iv
 Wilson, H. H., vii
 Wise, T. A., viii

Y

- Yakritodara* (dropsy with invol-
 vement of liver), 169
Yantras (blunt surgical instru-
 ments) :
 description, 159, 160
 groups, 159
 number, 159
 uses of, 159, 160
Yavāgu (gruel) : preparation of,
 124
Yavāgu-kalpa, xxviii
Yoni (organs of generation, fe-
 male), 178
Yoni-vyapat (diseases of *yonī*) :
 causes of, 183
 description of each, 181-182
 number & varieties, 181
 treatment of, 183

Z

- Zimmer, H. R., ix



"A book that is shut is but a block"

CENTRAL ARCHAEOLOGICAL LIBRARY

GOVT. OF INDIA
Department of Archaeology
NEW DELHI.

Please help us to keep the book
clean and moving.

B. N. 148. N. DELHI.